PPTA

NEW ZEALAND POST PRIMARY TEACHERS' ASSOCIATION

TE WEHENGARUA

Theory of secondary teacher demand and supply

An NZPPTA paper to the Secondary Teacher Supply Working Party 2016

Contents

Theory of secondary teacher demand and supply

Data without theory is like wallpaper without a wall

A baseline theory

Extensive research of teacher mobility records in England and Wales (covering a 10 year period) by the London School of Economics, in conjunction with the University of Lancaster identified the factors underlying teacher supply[1]. The research was supported by the British Government through the secondment of a statistical expert to the project and provision of access to the full education employee database. The findings of this work form the basis of a coherent theory of secondary teacher supply, which has been refined by subsequent work internationally but not contradicted.

The supply of teachers in any given year is the total of those who enter the profession (recruitment) and those who remain in the profession (retention).[2]

Entrants include new entrants (mostly graduate entrants in secondary), re-entrants and transferees from other parts of the education sector.

The decision of qualified people to join the teaching force or to remain in the teaching force is one of occupational choice. The interacting factors identified in the report as influential in determining those occupational decisions were:

- relative salary
- salary profile
- relative career opportunities
- working time line horizon
- rate of discount

The same basic factors influencing recruitment also influence retention. Thus, changes in salary profile, relative salary, workload, stress etc. will alter both the rate of recruitment and the rate of retention, as will changes in the general employment scenario.

The **relative salary** rather than the absolute salary is important in recruitment and retention decisions. As salaries decline in relation to the earnings of the general population or to comparable professional groups it becomes more difficult to retain and recruit staff[3, 4].

[1] *The economics of teacher supply*. Zabalza A, Turnbull P, Williams G. 1979.

[2] Donitsa-Schmidt S and Zuzovsk R describe supply as *"the number of qualified individuals both able and willing to offer their services… depending on compensation". Teacher Supply and Demand: The School Level Perspective*. 2014

[3] Cameron cites Santiago,(2002) that "*evidence on the career decisions pf potential teachers, teachers and former teachers shows that they do respond to incentives. Salaries and opportunity costs strongly influence who goes into teaching, who stays in teaching and who returns to teaching after a career interruption."* She also cites unpublished research from the MoE which found that secondary teachers are reluctant to apply for HoD positions because the additional salary is not seen as worth the additional work.

[4] *The Economic Cycle and Teacher Supply,* Dolton P, Tremayne A and Chung T, 2003 examined the economic cycle effects on teacher supply for the OECD. It consolidated data from other research from the UK and USA and confirmed that "*relative*

If wage relativity across the whole workforce is relatively stable then the proxy can be relativity with the average wage. At any set relative wage level there are a finite number of suitable people interested in the job.

The **salary profile** considers the starting salaries, the top of scale salaries and the time taken to move between them has an influence on recruitment and retention. Teacher trainees rate top of scale salaries as more important in making decisions to enter teaching than starting salaries. It is to be assumed that those who do not enter into teacher education at all have a similar opinion.

Relative career opportunities are important - the easier it is to get jobs outside teaching[5] the more difficult it is to recruit and retain teachers[6]. The best proxy measure for relative career opportunity was found to be the unemployment rate amongst professional groups. An alternative proxy is the general unemployment rate. When the unemployment rate falls it is more difficult to recruit and retain teachers and other factors must be adjusted to maintain the same level of supply.

Time line horizon refers to the influence of immediate future gains against long term benefits in making choices between jobs, or between employment and retirement. It is effectively a measure of how far ahead people are planning, and the trade-offs they are prepared to make between short term and long term benefit. Factors currently affecting choice can include:

- immediate availability of a teaching job versus longer term employment prospects of alternative employment
- immediate teaching salary v. potential future salary in another job
- student fee costs for teacher trainees
- foregone earnings in the teacher education year
- student loan repayments
- superannuation issues
- career prospects

Rate of discount reflects the non-financial benefits or disadvantages of the job. It recognises the preparedness of people to forego some of the salary they might expect in a job other than teaching in exchange for non-financial benefits they perceive to be part of teaching. In a job with a high vocational component, employees will be prepared to forego some of the salary they could earn in the other sectors. When the rate of discount is high the relative salaries required to recruit and retain teachers are lowered. Conversely when

---

wages in teaching compared to alternative professions have a significant impact on the likelihood of graduates choosing to teach, although the impact depends upon the market situation at the time."

[5] The graduate subject specialist nature of the secondary teacher workforce means that they have alternative career options open to them In 1996 PPTA followed up over 200 teachers who had left teaching that year and found that they went to over one hundred different types of alternative jobs.

[6] Cameron, in the context of noting that in the past capable women had a narrower range of career options and that many became teachers, cites an American study of 2002 (Corocan, Evans and Schwab) which found that "*the likelihood that a female from the top of her high school class will eventually enter teaching has fallen dramatically from 1964 to 1992 by our estimation, from almost 20% to under 4%".*

the rate of discount is low, or falling, more money is required to recruit and retain the same number of teachers[7].

Thus, working conditions for teachers influence the number of potential employees who can be recruited, but much more importantly the numbers retained at any given relative wage level.

Factors affecting the rate of discount include:

- workload
- job-related stress
- health factors
- class sizes
- teacher morale
- the quality of student-teacher relations
- levels of support
- perceived societal value
- job satisfaction
- work-life balance
- security of employment[8]

Discount can be a critical component of recruitment and retention, particularly since teachers in subject shortage areas are relatively insensitive to salary differentials. These non-financial factors, along with the economic choices made by teachers interact to determine how many teachers elect to make themselves, or continue to make themselves, available to schools each year.

In a 2009 paper by Ingersoll R. and Perda D. focussing their research into the US mathematics and science teacher shortage make these points (which Zabalza, Turnbull, Williams would describe as rate of discount factors):

"… production and recruitment alone do not address a major source of the problem. The data indicate that there are sufficient numbers of qualified teachers, but not significant numbers of willing teachers. This analysis indicates that demand for new hires and the subsequent staffing problems are largely the result of pre-retirement turnover. Hence, this analysis suggests that recruitment programmes alone will not solve the staffing problems of schools, if they do not also address the issue of teacher retention."

".. the data indicate that over 35,000 mathematics and science teachers left teaching just after the 1999-2000 school year alone. Only 8,000 of these left because of retirement. Almost 18,000 indicated job dissatisfaction was a major factor in their decision to leave.

[7] Cameron cites Allen (2002) in The Ministry of Education's Teacher Status Project: Stage 1 Research, 2004 that "*All of the evidence reviewed to date signals that teachers are more likely to remain in teaching when their working conditions indicate to them that they are performing a role that is valued by society, that they have support from their colleagues and school leaders, that their workload is manageable, and that there are opportunities for career growth*." She notes that "*Teachers are unlikely to create and sustain environments that support intellectual challenge and creativity, unless their own working conditions are conducive to their own professional development."*

[8] Elridge reports in 2002 that 40.6% of beginning secondary teachers were employed on limited term contracts, compared to 21.4% of experienced secondary teachers.

"The data suggest that a key way to improve teacher retention is to improve the working conditions of the teaching job. In our research, we have found that schools with more support for new teachers, more generous salary schedules, fewer student discipline problems, more adequate resources and school supplies, more effective leadership, and enhanced faculty input into decision making – all have significantly lower levels of teacher turnover."

The generalised relationship between teacher supply and the economic cycle

In general terms therefore, the teacher supply theory framework indicates that the supply of teachers will be counter-cyclic to the general business cycle, with falling unemployment and rising general wages triggering declines in recruitment and retention of secondary teachers and rising unemployment and stagnant or falling general wages triggering improvement in teacher recruitment and retention, but with these factors having differential impact according to gender, subject qualifications, age and other factors, both individual and situational.

The Dolton, Tremayne, Chung work reconfirmed this:

> *"Overall our results suggest a significant relationship between the economic cycle and teacher supply when these effects are measured in terms of relative wages and unemployment (but not GDP growth) in gender-specific equations. Relative wages appear to remain as an important factor affecting the teacher labour market in the UK, specifically when we distinguish between the market for male and female teachers."*

They found, however that there was no significant relationship between GDP growth and teacher supply.

Teacher supply theory would have predicted that the Global Economic Crisis would have had a stimulating effect on teacher retention and recruitment [9]. It also predicts that the recovery from the crisis will have the reverse effect.

[9] The Ministry of Education noted this in its May 2012 report to the Minister of Education, '*Education Report: Teacher Supply and Demand Issues'*. They reported that after more than ten years of principals reporting difficulty in finding the New Zealand trained teachers they wanted, there was now low turnover in the teaching force (*not broken down by sector*) and that this was linked with global economic factors and was forecast to continue for another five years.

Refinements to secondary teacher supply theory

Teachers do not respond uniformly to the factors influencing overall supply. Beyond individual variances are some groups which have been identified as being affected differentially:

Gender

There were general gender differences in responses to supply factors[10], for example

- Males generally are more responsive to changes in the relative secondary teacher wage in their decision making and also are more responsive to future earnings in their decision making.

- Males are very sensitive to changes in career prospects.

- Males have a low rate of discount while female graduates use a fairly high rate of discount.

Cameron cited Edmonds, Sharp and Benefield (2002) in concluding "*although intrinsic factors are central to the motivation of people who want to teach, male trainees place greater emphasis on extrinsic factors, such as salary, holidays, promotion prospects and the opinion of others*".

Dolton, Tremayne and Chung identified a significant effect of fertility rate on the female teacher:student ratio, reflecting (rather unsurprisingly) that women tend to leave teaching after childbearing. They also confirmed the significant and greater response to male teachers to graduate unemployment, and to the relative wage.

Dolton, Tremayne, Chung made reference to teachers in the community pool but not actively teaching:

> *"…as the economy becomes better , more males are opting for alternative professions and not considering teaching as their next occupation."*
>
> *"…only relative wages matter among the (female) teachers in the pool of inactive teachers. .. If female teachers are paid higher wages they are likely to be in teaching."*

The earnings ratio of secondary teachers relative to the average total take home pay to the top of the base scale in 1985 was 1.89. The ratio at June 2015 was 1.59[11]. During the same period unemployment rates have peaked at 10.3% and fallen again to 5.9%. Over the same period the proportion of ale teachers in secondary schools has changed from 55% male to 45% male. Teacher education institutions nationally indicate that their intakes have a 60:40

[10] Ministry of Education figures show that from 1995 the proportion of males in the secondary teaching force fell from 53% to 41.6% by 2012. Over the same periods relative teaching wage fell from 1.954 to 1.611, measured by the ratio of the top of secondary salary scale to the average working wage. At one point it fell as low as 1.25.

[11] (Top of teachers base pay scale) divided by (annualised total weekly take home pay (all groups), August quarter.)

female gender bias. Supply theory predicts that such a gender change and generally deteriorating recruitment and retention over the period.

Graduate Discipline

Graduates from different disciplines had different characteristics with respect to the supply factors. For example:

- relative to other graduates male and female science graduates appear to be more influenced by alternative career opportunities than other graduates, but

- while male science graduates are most responsive to employment opportunities and less responsive to wage changes than arts graduates, female science graduates were more responsive to both salaries and to unemployment rates.

At a given wage the academic qualifications of arts graduates in teaching are higher than the academic qualifications of science graduates.

To the degree that there is a gender bias in the distribution of graduates across disciplines this will be reflected in the supply of male and female teachers.

Dolton, Tremayne and Chung detected a link in the UK data of improving educational quality impacting negatively on teacher supply, with a higher likelihood of teachers with better pre-graduation examination results more likely to leave teaching.

Age

Those most vested in their profession are less likely to be influenced in their decision to stay than those with less time in the profession[12]. Late career-changers were more likely to remain in the profession when wage factors declined than others.

Ethnicity

The Zabala, Turnball, Williams analysis did not investigate the interaction of ethnicity with the various factors. However, in its August 1995 paper to Cabinet on teacher supply[13] the Ministry reported its expectation that the severest shortages were predicted to be in Maori teachers, speakers of Te Reo and in specialist areas.

Cameron also noted in 2004 a pattern emerging of few Asian students entering teaching. American research quoted (Gordon, 2000) identified the main source of resistance to entering teaching for Asian students was intense pressure from parents to strive for careers perceived as higher status with greater financial rewards. In the same report Cameron identifies differences in recruitment and retention of Maori teachers and Pasifika teachers,

[12] Elvridge C. reports in Teacher Supply: Beginning Teacher Characteristics and Mobility May 2002, MoE, that secondary sector beginning teachers are more likely to leave from teaching from low and mid-decile schools than from high decile schools and are 50% less likely to return to teaching after a year than their primary equivalents.

[13] *Managing Teacher Supply*, 21 August 1995 paper to Cabinet Committee on Education, Training and Employment.

noting the decline in status of teaching in Pasifika communities as other more attractive occupation choices become available.

Role

When considering the demand and supply of teachers we should also note that there are equivalent demand and supply factors within the teaching force itself. The demand and supply issues for middle and senior leader positions are each significant subsets of the whole recruitment and retention framework of secondary teacher supply.

Reticulation

The movement of teachers between schools represents a refinement of the theory in that it is an extension into individual supply matters rather than overall recruitment and retention within the secondary sector.

In respect of reticulation, non-pecuniary factors appear to predominate. For example:

- Teachers in rural areas were less likely to move schools, and particularly less likely to move region[14].

- Schools with difficulties are perceived by teachers to have adverse non-pecuniary characteristics that greatly outweigh any monetary gain involved in moving to them[15].

- Teachers are more likely to move from schools with low socio-economic status.

Differences in non-pecuniary factors can therefore drive supply differently in individual schools or groups of schools[16].

[14] The relative stability of rural New Zealand school staffing, and a consequent aging of the rural teaching force, was noted in '*Rural Secondary Schools in Canterbury'*, Pearce D. September 1996. Many teachers reported the financial cost of changing positions as a deterrent to moving.

[15] Elvridge (2002) also reports that secondary beginning teachers are more likely to move to another school than experienced secondary teachers during their first year of teaching, but that movement is from low to high decile, with no movement in reverse.

[16] The MoE submission to the Minister of Education (December 2000) '*Project on Recruitment and Retention in Low Decile and Rural Schools – Findings and Options for Further Consideration'* noted that teachers in low decile and rural schools tend to have lower qualifications, employ more beginning teachers, have a lack of experienced high quality applicants and experienced difficulties filling particular subject vacancies and middle management positions. It identified the main barriers as negative perceptions, workload, physical and social isolation, concerns about careers advancement and access to professional development. In terms of supply theory, timeline factors and very low rates of discount apply to jobs in these schools. The February 2001 follow-up report to the Minister noted that increasing supply pressures in secondary schools would mean low decile schools and isolated secondary schools would be most affected (as the alternative employment factor of supply theory would suggest).

Secondary Teacher Demand

Whatever you shoot at is the enemy, whatever you hit is the target.

Zabalza, Turnbull and Williams (1979) took as their starting point a demand scenario in which a government's value judgements (expressed through particular student:teacher ratios) determined the demand for teachers when combined with a particular number of students locally and nationally, and a distributive allocation mechanism designed to achieve "*an even distribution of staffing standards across all geographic areas*", which they clarify as meaning demand should be evenly distributed over the whole country. Demand then is the measure of how many teachers are required in any year to achieve and maintain the desired even distribution of staffing standards. This will include the need for additional teachers for roll increases, the replacement of teachers leaving the service, adjustments for teachers reducing hours and rebalancing of transfers between schools and regions.

We would go further and say that the policy goal should be *an even distribution of staffing standards across all secondary schools.*

Supply then becomes the sources for meeting that evenly distributed demand equitably. Unfortunately supply is not evenly distributed, even at a national level[17,18].

When breaking the demand down further there are problems. In determining how many chemistry teachers are expected to be needed next year, is the analysis to be based upon the current stock of chemistry teachers (which under-represents the need for such teachers at a national level), on the minimum number of chemists that can be expected to be employed, on the measure of the number of chemists that schools identify they are short of or on some national assessment of the number of chemists that should be represented in a national workforce of a given number of secondary teachers? Does it take into account quality or simply quantity? Does it assume that there should be a surplus of chemists in the recruitment pool in order to provide assurances of quality and choice for schools and to maximise the chances of a fair distribution of chemists across schools of all types and locations, or is just enough, enough?

Clearly, demand cannot be assessed by a simple measure of advertised vacancies in the current year or by the current number of employed teachers of any particular subject speciality, particularly if it is about an even distribution of staffing standards in the qualitative as well as quantitative sense.

There also has to be consideration of measures of demand consider for teachers in middle and senior leadership roles. The likely need to replace those in such positions, the expected number of positions wanted (or needed) etc.

[17] Ingersoll and Perda note that secondary teaching has a highly localised labour market, and cite other research which raise issues of factors which impede cross-district hiring and mobility and a tendency for new graduates to seek jobs in schools close to home. This was also a finding of the PPTA survey of teacher trainees mentioned earlier. Ingersoll and Perda note however that some schools/regions are more successful than others in attracting out of district applicants.

[18] PPTA staffing surveys show that even during the Global Economic Crisis (and its predictable stimulus effect on teacher supply) there were jobs advertised by a number of schools that had no suitable applicants or even no applicants at all.

And, adding complexity in the New Zealand situation, the analysis cannot be restricted to the Zabalza, Turnbull, Williams framework of government-only generated demand but must include the effects of local (non-formula) generated staffing demand modelling will undershoot total needs and compound the inequity of supply.

Reticulation gradients

Reticulation is the movement of teachers within schools and between schools and regions.

The movement can be triggered by promotion within or between schools, personal circumstances (e.g. changes in a partner's employment location), timeline horizon factors (such as anticipating improving career prospects), or rate of discount factors.

The latter might include:

- preference for a geographical location
- preference for working in urban areas or rural areas
- preference for working in higher decile schools or lower decile schools, etc

Reticulation may have some marginal impact on overall teacher demand (such as appointment of teachers in shortage areas to senior leadership positions increasing the demand for classroom teachers in those subjects) but it can have significant impact on local demand, which in turn has implications for the provision of *an even distribution of staffing standards across all geographic areas and in all secondary schools.*

Where there are reticulation gradients (e.g. disproportionate drifts from low to high decile, rural to urban schools) then there will be poor reticulation which will cause an excess of demand for applicants for some schools/roles and a low demand in others.

Such an unbalanced distribution then requires either a demand response (to increase the numbers of teachers required to achieve an even distribution of teaching standards) or supply response (changing the supply factors which influence decisions about employment to rebalance the reticulation gradients.

However, without a full picture of both the national and the local demand and supply situations moving to address one may exacerbate the other or may intensify problems for some schools while addressing (in whole or part or not at all) those of others.

Reticulation measures have, for example, included:

- regional payments (e.g. the London Allowance)
- hard to staff payments (currently HPTSA and SIA)
- transfers and removals (currently STCA provisions)
- country service bar (prior to 1989)

Arguably no reticulation measures can work when the supply pool is not full, if they target the wrong cause or if they are not set at a sufficient level to overcome rate of discount issues.

Measuring Demand

If demand is the number of teachers needed in any year and is currently generated by:

- the number of students expected,
- the age profile of those students,
- the proportion of students who are in Maori immersion education,
- the staffing ratios and other formula-driven staffing,
- the number of schools operating within the state and integrated system,
- the number of teachers to be replaced from the previous year's stock[19,20]
- the need for above entitlement teaching staff employed by schools, and
- the optimum degree of choice for schools when selecting candidates.

Then how it can be measured can be considered in a number of ways:

1 How many positions will be paid for by government?

This is the easiest measure of demand.

The government sets a number of full time positions it will pay for, and allocates those FTTE across school. There is an easy measure of the total number of full time equivalent positions required nationally, regionally and by school and is fundamentally a resourcing allocation model.

The figure will be change from year to year depending on government policy and student demographics. However, given consistency or predictability in those factors, this measure of demand will be easily calculable.

A more sophisticated assessment would include some indication of the FTTE of teachers required with varying specialisms, and at middle and senior leadership levels and take into consideration any policy on desired representation of demographic groups within the teaching force.

[19] For retirement, resignation for career change, long term leave, emigration, transfer to other parts of the education sector etc.

[20] In research reported in 2001 (Teacher turnover and Teacher Shortages: An organizational Analysis. Ingersoll R) Ingersoll concludes that "*school staffing problems are primarily due to excess demand resulting from a 'revolving door' – where large numbers of qualified teachers depart their jobs for reasons other than retirement. Moreover, data shows that the amount of turnover accounted for by retirement is relatively minor when compared to that associated with other factors, such as teacher job dissatisfaction and teachers pursuing other jobs ..* [and] *popular education initiatives will not solve the staffing problems of such schools if they do not also address the organisational sources of low teacher retention."*

2 How many positions will need to be filled?

The government sets a number of full time positions it will pay for, and allocates those FTTE across school. To this is added the number of positions that are required by schools to meet the needs that are not met by the government allocation and this gives the total number of full time equivalent positions required nationally, regionally and by school.

The figure will change from year to year depending on government policy, student demographics and the ability of schools to hire for unmet needs.

Again, more sophisticated assessment would include some indication of the FTTE of teachers required with varying specialisms, and at middle and senior leadership levels and the desired representation of demographic groups.

3 How many teachers will be needed?

In both the centrally-paid model of national demand and the model which counts the positions required by schools, the number of teachers required to fill the FTTE will exceed the number of FTTE to compensate for:

1. Part time and job share positions
2. Relieving positions

For example, a 0.5 FTTE position in Marlborough and a 0.4 FTTE position in Whakatane means two teachers are needed, not fewer than one.

Again, sophisticated assessment would include an indication of the number (headcount) of teachers required with varying specialisms, at middle and senior leadership levels and will take into consideration policy factors such as desired representation of demographic groups within the teaching force.

4 How many people will we need to hire?

This measure of demand requires more detailed analysis and depth of data plus application of supply theory to the demand side.

The number of new hires required in any year will depend upon:

1. Changes in government policy
2. Changes in student numbers or profile
3. Changes to schools' local funding employment practices
4. Attrition from within existing employees (resignation, retirement, death, long term leave etc.)

Again, the 'need to hire' measure will, in a sophisticated model, give some indication of the number of new hires likely to be required across subjects and across roles and any demographic considerations.

This model of demand would incorporate supply theory to anticipate projected changes to attrition rates, linked to projected changes in employment and to projected changes in relative wages over the demand projection period.

5 How large a pool will we need to hire from?

This measure of demand incorporates the notion of quality of appointments. It moves beyond a simple matching of numbers to expected positions to anticipating that there will be an adequate choice of suitable applicants for the positions, and therefore anticipates that more potential willing and qualified teachers will be required than the number of teachers who will need to be hired in order to ensure that schools can appoint the most suitable and appropriately qualified people to positions and at least maintain, if not improve the overall quality of the teaching force[21].

There may also be some assessment incorporated about the most desirable gender and ethnicity balances within the secondary teaching workforce.

Timeframes for projecting and assessing demand

Each of the above measures is suited to a different length of projection and prediction:

- Demographic changes can be predicted for some time ahead, clearly with less and less accuracy as the projection period increases.

- Government processes require funding projections for a four year period and significant policy changes can occur within each three year period.

- Shifts in key supply factors (unemployment, relative wage changes) are regularly projected over a three to four year cycle but can occur more quickly.

- The gap between the number of new hires required and the retention of existing hires has to be filled from the community pool of potential willing and qualified teachers, overseas teachers and new graduates. Shifting numbers in the latter category can represent a lag phase of one to four years from the implementation of measures to influence predicted shortfalls.

This suggests that while long term projections of demand are useful, the best management of supply will fit with active assessment and analysis of demand fits over a 4-5 year frame.

However, for some initiatives this time frame may be too short. For example, it is arguable that the shortage of trained physics, mathematics and chemistry teachers is:

[21] Principals observe that they often have applicants for roles that are unsuitable for appointment, or would be last choice candidates if there were other applicants for the advertised job.

- a consequence of too great a disparity in relative wages in teaching and other graduate jobs for those with these degrees – in which case the solution is to raise the teaching salary and so the time for frame resolving it may be as short as a year, or

- a consequence of rate of low rate of discount – in which case conditions implements and removal of barriers, improved career opportunities etc. may be the solution and the time frame may be three or four years, or

- a consequence of having too small a pool of graduates which means that the relative degree of alternative employment is very high and the relative wage being held artificially high be competition with the private sector – in which case the solution is to increase the size of the pool of graduates, reducing the relative level of alternative employment opportunity and reduce the relative wage pressures, in which case the start of the solution may be with students currently in or about to start secondary schooling and the timeframe being ten years or longer.

Secondary teacher supply

Supply refers to the number of teachers or potential teachers qualified and willing to be available. It includes the number expected to remain in the system (retention), those expected to join the system for the first time (recruitment), and those expected to return to teaching (re-recruitment).

The supply of trained and qualified secondary teachers includes:

- Retention of those teachers already in schools
- The return of teachers who had left teaching
- Use of relief pool teachers
- Recruitment of overseas teachers
- Recruitment of teachers from other parts of the sector
- The retraining of teachers from other parts of the sector, or who have been out of the secondary system for some time
- The graduation of newly trained teachers
- The increased use of under-employed teachers within the system.

The balance between demand and supply creates a teacher shortage or surplus and this balance influences the overall quality of appointments into the profession each year.

Graduate subject distribution is critical within the total pool of secondary teachers. The supply needs of secondary schools are complicated by the specialist nature of secondary teaching. For example, approximately 14% of all timetabled secondary positions are maths. In a balanced supply situation 14% of teachers should be trained mathematicians.

Qualitative, quantitative and equity aspects of secondary teacher supply

Secondary teacher supply is about more than matching the number of applicants with the number of vacancies. Inadequate supply impacts on the overall quality of the teaching force in schools[22]. Where there are few applicants for advertised positions schools have limited choice in appointments. Where choice of appointment is limited, the options are often either to not appoint or to appoint someone less than adequately suited to the position. Matters of equity arise when only some schools can choose from wide and well qualified pools of applicants.

The qualitative staffing needs of secondary schools require teachers who are:

- Subject specialist tertiary graduates
- Secondary teacher trained
- Of suitable character for teaching

[22] Cameron noted in 2004 that it is" *likely that greater numbers of very able applicants would raise both the status and the capability of the profession".*

- Competent in classroom management, pedagogy, assessment for qualifications and formative assessment of students.

The quantitative staffing needs of secondary schools require an adequate number of teachers to create sufficient:

- applicants for vacancies in each subject area
- applicants for vacancies for all subject, pastoral and administrative positions
- choice of applicants for any position to ensure that all positions have several applicants of high calibre and qualifications to select from.

This implies that the maintenance of a high quality teaching force is dependent upon generating a surplus of suitably trained and qualified people within the potential recruitment pool who wish to be employed (or reemployed) as teachers.

The equity of secondary teacher staffing requires mechanisms to ensure that:

- all schools have access to an adequate pool of applicants regardless of the location or decile of the school, and that to achieve this,

- there are appropriate and effective reticulation mechanisms in place.

In a healthy teacher supply situation all components of the teacher supply equation are balanced and operating within a coherent and internally consistent policy framework.

Retention

The main component of a healthy teacher supply pool is retention. Supply theory indicates that declining retention of teachers in the secondary sector is likely to reflect:

* declining wage relativity in comparison with other professions within New Zealand and with overseas teaching salaries
* falling rates of discount - increasing workload and stress, reduced job satisfaction, increasing disenchantment with teaching as a career
* falling unemployment and greater job opportunities outside teaching
* opportunities for teaching positions overseas
* an ageing teaching population

Young teachers, especially at the end of their third year, have particularly high loss rates. As the number of young teachers increases, the total numbers lost from these cohorts become increasingly significant.

There are many teachers in the 45-54 year age cohort, which generates numerically the most leavers despite relatively low loss rates. When this cohort moves into age bands with higher loss rates, the real losses increase. Overall loss rates, boosted by rising actual numbers in high loss rate age cohorts at both ends of the scale, naturally tend to worsen.

A few percentage points improvement in the retention rates can add several hundred secondary teachers to annual supply.

For some schools the retirement of existing staff poses a significant reduction in their own teacher supply over the next few years. Those schools are more vulnerable to supply problems than schools with low numbers of teachers approaching retirement.

A considerable number of newer teachers are hired on fixed term contracts[23], and most would prefer a permanent appointment. Many of these will leave teaching without registering as losses as they would have done were they appointed to permanent positions. With a trend away from 'regular' employment (full time permanent), more emphasis is needed on monitoring to assess the implications to supply of such precarious employment arrangements.

With respect to losses to overseas teaching systems, New Zealand's own teaching pool is relatively small and active recruitment to much larger overseas education systems can have a significant impact on retention here relative to quite small change to the overseas pool(s).

Recruitment

Recruitment, bringing into schools secondary teachers who have not held secondary teaching jobs in the previous year, naturally forms an important component of maintaining a balanced supply of teachers, but, as noted by Ingersoll and Perda, it has major disadvantages as the key tool in a supply policy framework.

1 Recruiting from teacher education institutions

The number of secondary teacher trainees entering teaching in any given year depends upon:

* the number of places in secondary teacher education which the Government will fund in the previous year (there is a one year lag caused by training)

* the number of graduates with the appropriate qualifications, skills and personal qualities needed to be a teacher

* the number in the potential pool of candidates who are willing to enter teacher education under the prevailing conditions and the entry restrictions in place

* the number of secondary teacher education places filled

* the number of students who complete their training

* the number of qualified graduates who decide to teach after completing their teacher education successfully

[23] The Ministry of Education reported in May 2012 that only one in five new graduates would find permanent employment in their first year of teaching (*not broken down by sector*).

* the match between the subject specialisms of the graduating students and the subject needs of secondary schools.

Supply theory tells us that under any given set of parameters there a limited number of potential secondary teacher trainees. Creating teacher education places cannot in itself increase the pool of willing applicants, though it can capture more of them if the demand for places exceeds supply at the time. For example, in 1959, when subject quotas were more rationally controlled, there were 500 Teacher Studentships available and 720 applicants. Increasing the number of Studentships by 100, without changes to any other factors influencing decisions to become teachers, caused the number of applicants to increase only by 27. A generation later, in 1986 there were 950 teacher education student places available, but only 785 applicants.

Secondary teacher places are funded on the basis of the number of students the institutions can get. Primary and secondary students are funded at the same rate. This puts pressure on those secondary student teachers for three reasons:

1. If places cannot be filled funding is cut. This puts pressure on ITEs to fill places. Excessive numbers of primary students are one consequence of this. Another is a tension between quality and quantity of applicants accepted.

2. Secondary teacher education is more expensive than primary because smaller option groups have to be run to accommodate subject specific pedagogy and management techniques as well as the more general aspects of the theory and practice of teaching. Secondary teacher education therefore has to be cross-subsidised from primary funding, if possible, or cost cutting in secondary courses, or limitations on subjects which can be offered.

3. Teacher education institutions are forced to compete with other teacher education providers, including private providers. This limits the opportunity for co-operation and specialisation which might otherwise develop and allow the most efficient use of resources in the sector and secure the viability of courses for which there are relatively few applicants nationally.

A number of scholarship models have been tried and are currently operating to attract new graduates and career changers into secondary teacher training.

Suitable graduate numbers

Secondary teacher supply issues arise most acutely in subjects where the graduate pool is thin. The limited number of undergraduates in degree courses in mathematics, chemistry, physics and technology means that there are very small pools of graduates who might consider teacher education with these specialities. Research also identifies such graduates as relatively unlikely to consider teaching as a career. At average rates of recruitment into teacher education institutions therefore, these groups are greatly under-represented, and so are similarly under-represented in the secondary staffing pool.

Other disciplines may not be under-represented in the undergraduate pool, but face huge recruitment competition from private industry e.g computing.

Willing candidates for teacher education

Supply theory suggests that the size of the potential student pool within the new graduate group and within the broader community pool of potential teachers is determined by relative salaries, alternative career options, perception of teaching, entry standards and the financial barriers to training.

The theory also suggests that many potential candidates will be deterred by the salaries offered, have preferences for alternative employment or will be deterred by factors like the financial costs of teacher education (including foregone salary, student loan costs and course costs), and by their impressions of secondary teaching as a job[24]. In addition, many secondary teachers report that they will not recommend their profession to their most able students.

About 60% of applicants and students nationwide are female. This suggests that secondary teaching is less attractive to males than it has previously been and indicates significantly reduced potential recruitment into teacher education from one half of the population.

In 2001 one of our main teacher education institutions surveyed those who expressed interest in information on secondary teacher courses (89.3%), but had not applied for a place in 2000, asking why they were not applying. Of these individuals, who presumably had some pre-disposition to teaching, 75.1% did not submit applications to any teacher education institution, and of these:

- 21.4% gave financial reasons,
- 21.4% did not have the appropriate subjects at degree level,
- 23.8% cited personal reasons,
- 9.5% decided they wouldn't enjoy secondary teaching and
- 4.8% found the programme not to be what they had expected.

It is likely that these figures represented the national situation.

Retention through initial teacher education

Data from the early 2000s indicated that 15% of secondary teacher trainees did not complete the course. This is unlikely to have changed significantly.

Deciding to teach

Of those completing their courses, around 80% of new teaching graduates go into teaching. A survey of teacher education students indicated that the critical considerations they give to decisions about taking teaching jobs related to:

[24] In 2001 there were fewer than 1.24 applications per place offered, compared with 2.4 for 1997. Overall application rates almost halved, from 265.4 applications per institution for the 1997 year to 145 applications per institution for the 2001 year. (Source PPTA surveys of Initial Education Providers.)

- Rate of discount factors - finding a job in the right location (35.5%), workload involved (28.9%)
- Salary factors - the top of scale salary (20.8%), starting salary (13.8%)
- Timeline horizon factors - student loan repayment (16.8%), promotion prospects (13.4%)
- Alternative employment options - the availability of jobs outside teaching (13.9%)

Since the location of the school offering positions is quite a critical factor in their decision to enter into teaching after they graduate, this has reticulation implications and has implications for both the supply in in rural, isolated and low decile schools and the possible loss of graduates into the supply pool.

Subject specialist matching

There are no quota set for subjects which are understaffed. The existing funding mechanism encourages institutions to offer more places in some subjects than actual demand would warrant. This creates a surplus in some subjects (for example PE) which creates a pool of sufficient depth to give schools a choice of applicants and raises the overall quality of the qualifications of teachers in those subjects. It also imposes a financial cost on those teachers who train and then cannot find a position in the short to medium term. In this sense the costs of maintaining high quality subject pools are borne by the teacher education students.

The contra situation is an undersupply of teachers in other subjects. Initial teacher educators do not have the security of resourcing which allows them to plan their recruitment to meet the subject needs of schools.

There are problems with relying heavily on new recruitment. These include:

* High new recruitment rates changes the profile of the teaching force, potentially raising the overall loss rates.

* Replacing older teachers with younger ones reduces the overall level of experience in the teaching pool - affecting the reserve of potential middle management recruits and diminishing the skills and knowledge levels required to administer the curriculum and assessment changes being implemented.

* Oversight and support of a high number of new teachers places additional workload on existing staff, adding to retention pressures and reducing the individual level of assistance which can be provided to a new teacher.

2 Re-recruitment

Re-recruitment draws from the community pool those trained teachers who no longer teach.

Statistics New Zealand indicated, following the 1996 census, that there were some 60,000 people in New Zealand with teaching qualifications who were in jobs other than teaching.

Assuming half of these were secondary teachers, this suggests there was a pool of some 30,000 non-teaching secondary teachers which, even at low recruitment rates, would have yielded significant numbers of additional teachers in the right circumstances.

Evidence provided to the Arbitration Court in 1986 indicated that re-recruitment drives had little effect other than to bring back at an earlier date those who were already contemplating returning. This would support the prediction that would arise from applying supply theory – unless the average wages are changed upwards, employment options deteriorate outside teaching or there are some significant shifts in rate of discount factors, advertising teaching positions is in itself unlike to alter the decision not to teach.

There have been free short term courses to re-train ex-teachers and encourage them back into the classroom, but these are not offered currently. (The Education Council currently requires returning teachers who have been out of the classroom for six years or more to complete a Teacher Education Refresh programme at a cost of approximately $4,500.) Ensuring those who may be drawn back into teaching after some time away have an opportunity to upskill themselves in relation to the changes that have occurred in curriculum, assessment, discipline techniques, student behaviour, operational and structural changes etc is a positive move but it is more likely to be removing barriers to those who have decided they wish to be employed again as teachers rather than increasing the pool of willing potential teachers. At the same time, the current policy of charging such applicants to do this retraining is likely to operate as a disincentive rather than an incentive.

Teachers leave the secondary service for a number of reasons. These can be separated into discrete groups:

1. Inaccessible for re-recruitment: death, dismissal, retirement. (Though retirees may form part of the day relief pool.)

2. Limited potential for medium to long term re-recruitment: health reasons, other employment, transfer to private schools, early retirement. These people are unlikely to return to teaching unless there are significant shifts in supply factors. Again, retirees may act as part of the short term relief pool.

3. Reasonably high potential for medium to long term re-recruitment: family leave, travel overseas. These people are likely to return in the short to medium term and form part of the normal annual recruitment from the community pool each year. Many form part of the day relief pool.

3 Primary-Secondary flow

Prior to 1997 there was traditionally a small net gain to secondary from the primary sector - approximately 60 or so per year. This was in an environment when there was a salary differential of some $10,000 between secondary and primary teachers. Despite significant pay differences that existed pre-1994 there was not a significant flow of primary teachers to secondary schools. In part this is a matter of discount factors (for example primary students are different to secondary students) and in part to the expectations for entry (secondary

teaching positions normally require both teacher education qualifications and a level 7 subject qualification).

Pay parity, entrenchment and increased workload in secondary schools have upset the balance of this flow. The former is clearly a shift in the differentials between the average wage ratios of the two sectors and the latter shifts the rate of discount in secondary schools.

Supply theory would predict that there would be a supply shift from secondary to primary.

ITEs now identify many potential recruits who would previously have been expected to opt for secondary teacher education programmes and are now electing to undertake primary teacher education.

4 Overseas recruitment

There is an international shortage of secondary teachers. For many OECD countries roll growth at the secondary level, an ageing teaching force and other factors have created supply pressures. New Zealand is a small player in an increasingly aggressive international teacher supply market.

Data indicates that the highest proportions of overseas teachers go into lower decile schools and into schools with high Maori populations. This suggests that there are challenges for both the individual teachers arriving into the New Zealand education system and for the schools which are most likely to be employing them.

5 Drawing from the relief teacher pool

The broader community pool of qualified and trained teachers in the wider community are those who are or could be registered and certificated and could potentially be placed in front of a class of students. It composes several groups, which range from permanently inaccessible to immediately accessible for teaching:

1. Teacher education graduates who elected not to go teaching, retired teachers who will no longer teach, teachers who have left for other jobs and do not intend to return to teaching.

2. Teachers who have left to go to other jobs/family commitments/unemployment and might return, and teachers who have gone overseas but may return to teaching in NZ.

3. Those away from teaching (new job/health/family/other reasons) who do relief work but will not generally take permanent or long term positions. (This may include retirees, family caregivers, newly qualified teachers etc.)

4. Teachers who do relief work and will generally take permanent or long term positions. (This may also include retirees, family caregivers, newly qualified teachers etc.)

The pool provides:

- Limited cover for teachers on short term absence on training courses, sick leave etc.
- Longer term cover when permanent teachers take extended periods of leave.
- A source of teachers for casual vacancies which arise during the school year.
- A reservoir source of trained and qualified teachers for permanent jobs which become vacant through the year.
- A reservoir of trained and qualified teachers for addressing unexpected shortages in the supply pool.

Achieving a reasonable size in the relief pool relies upon having an excess of teachers seeking permanent positions, and having conditions which encourage those not seeking permanent positions to instead engage in short term or day relieving.

A sound and well stocked relief pool is both a sign of and an essential component of a healthy teacher supply. Expanding the relief pool with untrained and/or unqualified relievers may provide some assistance in day relief (if quality issues are ignored), but fails to enhance the other functions of the relief pool, which are more significant in a time of teacher shortage.

In 1996/7 there was a net under-supply of teachers in the system and over 200 job vacancies could not be filled. In March 1997 the average number of relievers per secondary school was approximately 9 (including untrained and/or unqualified relievers) and the pool was depleted of the longer term relievers or permanent job seekers as schools utilised them to fill vacancies, either temporarily or long term. Since then the stock of relievers has declined and risen in accordance with standard supply theory projections as the key supply variables have shifted. Careful monitoring of the supply pool is important as a decline in the relief pool signals (and may be an advance sign of) a decline in overall teacher supply and leaves fewer people available to schools for general relief functions and for filling positions which become vacant during the year.

Measuring teacher supply

A theory without data is like a car without petrol

In *'Teacher Supply and Demand: The School Level Perspective'* Donitsa-Schmidt and Zuzovsky (2014) note that the operational definition of a teacher shortage is not consistent between jurisdictions. They observe that one easily observable quantitative measure, the number of unfilled teaching positions, is hard to rely on.

Most positions are filled at the start of the school year and few students are turned away because of a lack of teachers. The referenced report identified a balance between supply and demand at the start of the year, but an ongoing search for teachers through the rest of the year.

An alternative measure therefore is the 'hidden shortage' – the number of untrained or unqualified (out of field) teachers employed to fill the gap created by the absence of a qualified teacher. These, plus the use of relief teachers, increasing teacher workloads, increasing class sizes and cancelling or transferring courses solve (and hide) an immediate teacher shortage in the school and affect the quality of the recruited workforce.

Aging workforces can also indicate issue with teacher supply, as can the attrition rate, low levels of interest in teaching positions or training for teaching positions.

Grace R. G. and Lawn M. in '*Teacher supply and Teacher quality: issues for the1990s'* (1991) observe that the DES measure of teacher shortage was the annual survey of teacher vacancies, which they argued gave a relative indicator of shortages across subjects, but little more than that. They too refer to the hidden shortage, which they regarded as a more sensible measure of supply needs.

PPTA conducts an annual survey of school staffing in the second half of term 1 each year. The date is set specifically. Schools are notified of their predicted staffing needs in September of the previous year. Approximately half of schools will get a prediction which is less than the actual number of staff they will eventually need. Schools are then left with four months to fill positions which are vacant. A first day of term survey on staffing vacancies therefore will measure how successful schools were in filling fewer positions than most will actually require with four months' notice at the point in the supply cycle when the recruitment pool is at its deepest.

However, the school may well then find that they have more students than projected and more teachers to find but not be in a position to do that until February, March or even later if waiting for the official staffing entitlement adjustment. They will be doing so when the recruitment pool is depleted and are more likely to move into making decisions which lead to hidden shortages.

So, timing of such 'gap' measurements can be crucial.

Another measure of shortage is to count the number of repeated jobs ads. Principals have raised doubts about the accuracy of this measure too. They indicate that, particularly when they have a subject which is hard to staff, or are in schools that are generally hard to staff,

they will often not re-advertise a vacancy if they have any applicant at all who can fill it, regardless of the appropriateness of the appointment. Alternatively they will, after an initial failure to get applications, reshuffle their staffing internally and advertise a different job, again taking the actual vacancy off the radar.

There is a more fundamental problem with such measurements however. They are not really ways of monitoring teacher supply but are both about identifying when secondary teacher supply has reached the point of failure, either for the system or for parts of it.

If there is to be effective use of supply theory to manage the quantity and quality of the secondary teaching workforce, then more effective and deeper measurement would be recommended, for example:

1. Exit surveys of teachers to monitor reasons for leaving the profession
2. Regular monitoring of the size of the secondary teacher relief pool
3. Regular monitoring of the number of teachers employed by local funds and the reasons
4. Monitoring the use of fixed term appointments and destination of teachers from those appointments
5. Monitoring of the number of applications from suitably qualified teachers for teaching, middle and senior leadership positions and principals 'positions
6. Two yearly assessments of the 'mood' of the profession
7. Ongoing monitoring for inadequately filled vacancies (cancelled courses, transferred courses, unqualified appointments, internal reshuffles and job redesignation
8. Mid-year assessment of appointments and vacancies
9. Monitoring of ITE intakes for subject, gender and ethnicity breakdowns and for application numbers
10. At least two yearly monitoring of secondary and tertiary student attitudes towards secondary teaching

Finally, measuring and separately recording data for primary (non-specialist) teachers and secondary (graduate specialist) teachers should be the normal practice.