

Supply of secondary teachers in STEM-related disciplines

29 JANUARY 2019



NEW SOUTH WALES AUDITOR-GENERAL'S REPORT

PERFORMANCE AUDIT

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In accordance with section 38E of the *Public Finance and Audit Act 1983*, I present a report titled **'Supply of secondary teachers in STEM-related disciplines'**.

A handwritten signature in black ink, appearing to read 'Margaret Crawford'.

Margaret Crawford

Auditor-General
29 January 2019

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Section one

Supply of secondary
teachers in STEM-related
disciplines



Executive summary

In recent years, Australian and international education policy has focused on improving outcomes in Science, Technology, Engineering and Mathematics (STEM) subjects. However, research has identified a shortage of qualified secondary teachers in STEM-related disciplines.¹ This is projected to worsen due to a combination of student population increases, an ageing workforce, and fewer people going into teaching. Shortfalls are likely to be more acute in rural and remote areas, and areas of low socio-economic status.

The Department of Education (the Department) has a variety of strategies to encourage teachers to practise in locations or disciplines of need. These include scholarships for tertiary students going into teaching, sponsorships for teachers seeking approval to teach additional disciplines, and incentives to attract teachers to rural and remote locations.

This audit assessed the effectiveness of the Department's workforce plans and strategies in responding to the demand for secondary teachers in STEM-related disciplines. We assessed:

- how well the Department tracks the supply and demand for secondary teachers in STEM-related disciplines across NSW
- whether the Department has effective strategies to attract and retain secondary teachers in STEM-related disciplines.



Conclusion

There are two key shortcomings that fundamentally limit the effectiveness of the Department's plans and strategies to respond to the demand for secondary teachers in STEM-related disciplines. First, the Department is not accurately tracking the supply and demand for secondary teachers by discipline due to incomplete data. Second, not all scholarship and sponsorship places are allocated and many scholars withdraw from the programs before completion. The Department has recognised and started to address these problems with a new workforce model, revised incentives and scholarship programs.

The Department's current workforce planning model does not provide the information needed to target workforce plans and strategies to areas of need. This is because it does not predict supply and demand for teachers by discipline and location. An internal review in 2017 acknowledged the limitations of this model. In response the Department developed a new model, which it is currently enhancing, to predict supply and demand for teachers by discipline and location. For this to be successful, the Department needs to monitor the level of out-of-field teaching and improve data on the willingness of teachers to work in particular locations.

The Department does not allocate all available scholarship and sponsorship places and around 30 per cent of recipients do not complete the term of their agreement. An internal review in 2017 highlighted that some programs were not targeting workforce need and that there were no key performance indicators to determine the overall effectiveness of these programs. However, scholarship programs and incentives are promoted well through social media and face-to-face events at Universities. Further, the Department has used findings from internal reviews of incentives and scholarships in 2016 and 2017 to inform recent changes to programs.

The Department has little oversight of access to practicum placements for pre-service teachers in areas of need. Professional experience agreements were established with each University in 2015 to improve the placement process for disciplines of need. Initial teacher education students must complete several 'practicum placements' before they can be qualified to teach in a school. Several universities we consulted reported difficulties finding practicum placements for pre-service teachers specialising in STEM-related disciplines. The Department is now revising the agreements to improve the quality of data it collects on the number, location and subject area of practicum placements.

¹ Australian Council for Educational Research 2015, The teacher workforce in Australia - supply, demand and data issues.



1. Recommendations

By December 2019, the Department of Education should:

1. Improve its workforce planning model to better understand and communicate supply and demand for teachers by:
 - determining the extent, and analysing the impact, of out-of-field teaching by permanent and temporary teachers in each school
 - sourcing additional data to more accurately reflect teacher location preferences
 - projecting supply and demand by subject level and geographic area
 - regularly reporting on the supply and demand for secondary teachers in each discipline to communicate future areas of need to future teacher education students.
2. Implement changes to address the findings of the 'Teacher Scholarship Realignment' report, including by:
 - testing a range of program designs with target candidates to determine the best options to attract more suitable applicants
 - establishing key performance indicators, and setting targets, to better monitor the effectiveness of the programs
 - reducing the number of scholars appointed to over-establishment positions
 - increasing the proportion of scholars appointed to priority locations
 - further analysing scholarship recipients career paths to inform future improvements to the scholarship programs.
3. Review its role in the practicum placement process of pre-service teachers by:
 - analysing how many students each school accommodates per year, to ensure there are appropriate placements available for students in high needs disciplines
 - working with universities to facilitate practicum placements for scholarship recipients
 - establishing mechanisms for ongoing monitoring of its partnerships with universities to ensure they are meeting their aims.



1. Introduction

1.1 Accreditation and allocation

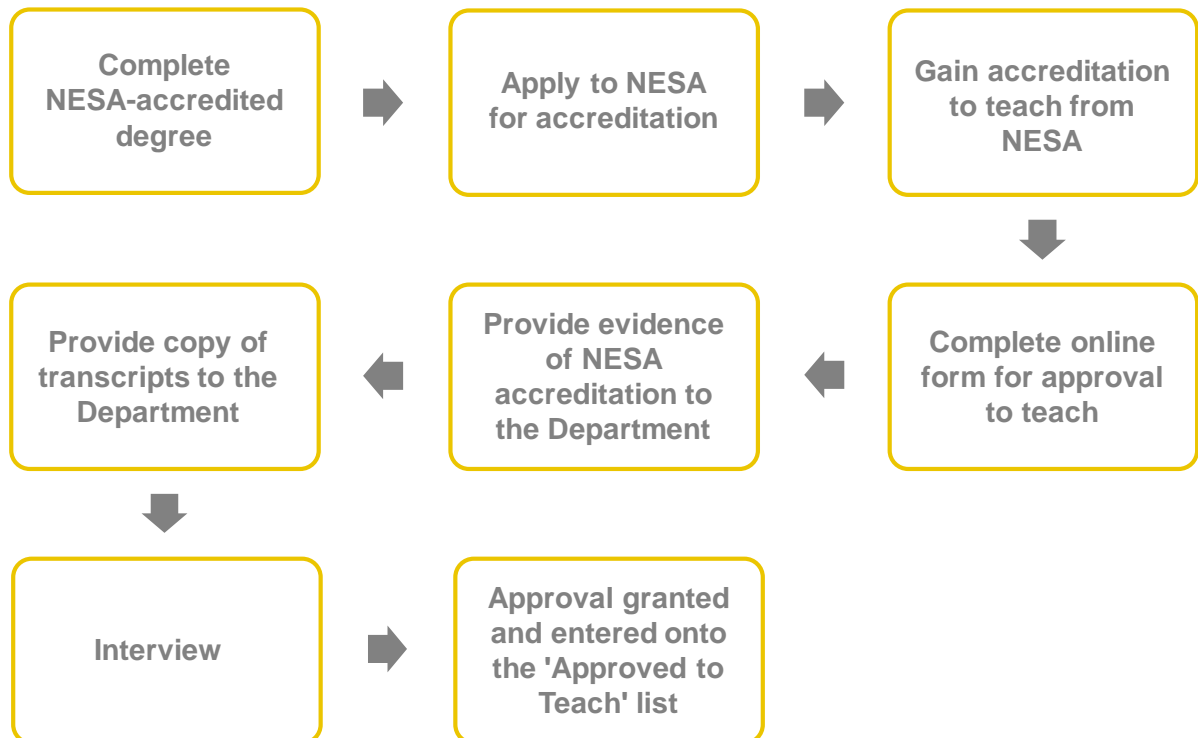
Accreditation of teachers

To be accredited to teach in NSW, pre-service teachers must complete a tertiary-level teaching degree approved by the NSW Education Standards Authority (NESA). Alongside teaching methods units, pre-service teachers must complete a range of discipline-specific units to become approved to teach in a certain discipline. Pre-service teachers can gain approval to teach additional disciplines by completing further sets of units that align with NESA's specifications. When pre-service teachers have completed their studies, they apply to NESA for accreditation to teach in NSW schools.

Teachers must also apply to the NSW Department of Education (the Department) for approval to teach in NSW public schools, shown in Exhibit 1. Pre-service teachers, and experienced teachers seeking employment in government schools, must:

- demonstrate that they have met NESA's accreditation standards
- demonstrate that they have fulfilled the academic requirements for their specialisation/s
- undergo employment screening including a Working With Children Check and a national criminal records check
- provide a copy of their academic transcripts to the Department
- sit an interview conducted by an education professional (usually a former principal or long-serving executive).

Exhibit 1: Pathway to be approved to teach in a Department school



Source: Audit Office research 2018.

Once the teacher has gained approval to teach in a Department school, they are added to the 'Approved to Teach' list and are eligible to be considered for casual, temporary or permanent teaching opportunities.

Allocation of teachers

The staffing entitlement of each school is determined by the number of students and their requirements, and the location of the school. Under the Local Schools Local Decisions framework, each school principal determines the best use of their entitlement to meet their school needs. Principals may hire additional teachers to cater for the needs of their students if the school has sufficient funding to sustain the position. When a vacancy arises, the principal informs the Department of the vacancy and specifies the required disciplines.

The Department uses two methods to fill vacant teaching positions on a permanent basis. These methods are central appointment and local choice. When a classroom teacher vacancy is available, the Department gives preference to 'priority central appointments'. Priority is given to candidates seeking a transfer following service in a rural or remote area and teachers who have identified as Aboriginal. If no suitable priority central appointment candidate is available, places are filled by other types of central appointment or local choice on an alternate basis.

Central appointments occur when the Department matches the subject specialisation and skills/experiences requested by the principal with teachers on a central database. The database includes nominated transfers based on changing school needs, service transfers, priority transfers of teachers in special education settings, graduate employment, sponsored teachers, and scholarship holders.

Local choice allows schools flexibility to choose how they will fill a vacancy. Some common methods are open and closed merit selection, and transitioning temporary teachers to permanent status. Principals can also decide to request the Department choose the most suitable applicant from the 'Approved to Teach' list. This list contains the specialisations and location preferences of teachers approved to teach in Department schools. Since 2013, 56 per cent of permanent appointments were made using local choice.

1.2 Teacher profile

Characteristics of teachers

At April 2018, there were around 22,500 teachers permanently allocated to Department secondary and central schools. Of these, around 9,000 teachers (or 40 per cent) were approved to teach in a STEM-related discipline (see Exhibit 2).

Exhibit 2: STEM-related disciplines

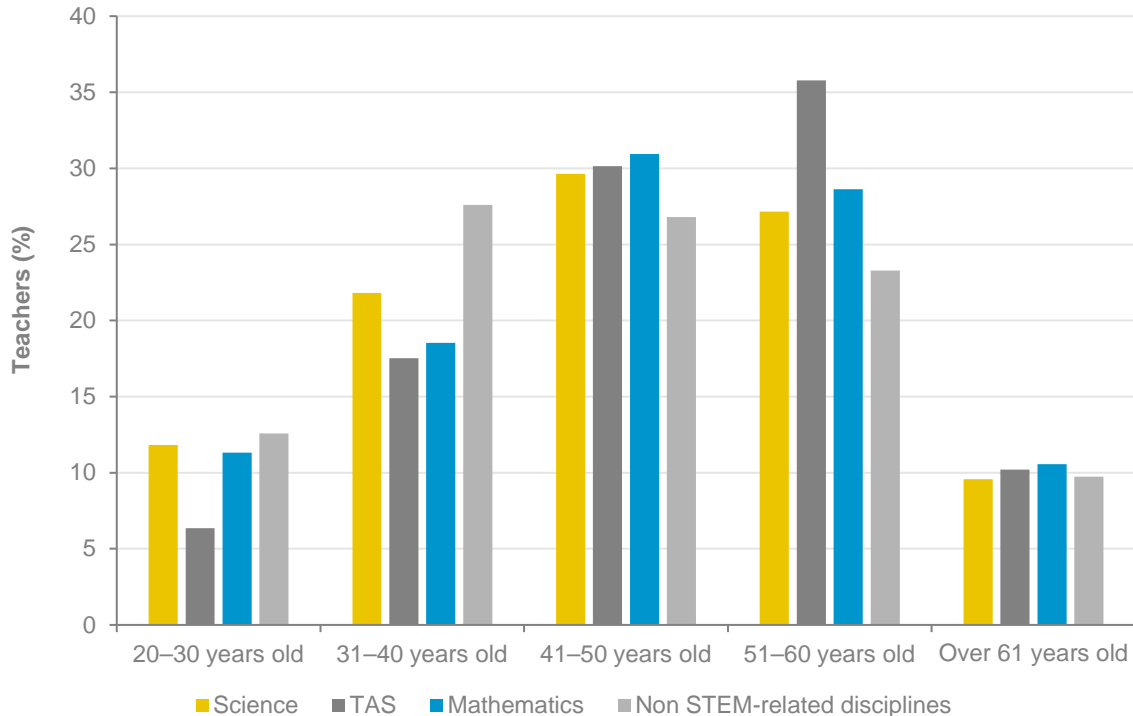
STEM-related disciplines taught in NSW secondary schools include:

- **Science** - Biology, Chemistry, Earth and Environmental Science, Physics and General Science
- **Technology** - Information Technology, Design and Technology, Food Technology and Industrial Technology
- **Engineering** - Engineering Studies
- **Mathematics** - Mathematics (various levels).

Source: Audit Office research.

Exhibit 3 compares the age profile of teachers in STEM-related disciplines to teachers in other disciplines. Approximately 40 per cent of teachers in STEM-related disciplines are over 50 years old. The proportion of teachers with non-STEM related specialisations aged over 50 is lower (33 per cent). Over the next ten years, a significant proportion of these teachers are likely to retire.

Exhibit 3: Age distribution of teachers in STEM-related disciplines



Source: Department of Education 2018.

1.3 Scholarships, sponsorships and incentives

Scholarship and sponsorship programs

The Department has a range of scholarships and sponsorships to encourage pre-entry and existing teachers to practice in a discipline, or location, of need. The scholarship programs are targeted at pre-service teachers, while sponsorship programs are targeted to upskill and retrain existing teachers. In 2017–18, \$13.8 million was budgeted for scholarships and sponsorships. This audit only considered scholarship programs that accepted candidates in STEM-related disciplines from 2013 to 2018, as shown in Exhibit 4. In October 2018, the Department announced changes to its scholarship programs from 2019 onwards. These changes were informed by its 2017 review of its scholarship offerings, but were not assessed in this audit.

Exhibit 4: Scholarship and sponsorship programs to address areas of workforce need in 2018

Scholarship program	Objective	Accepts STEM Candidates	Examined in the audit	Number of places	Total value (2017–18)
Teach.Rural	To attract students to teach in rural or remote schools	✓	✓	50	\$1,041,000
GTIL Cadetships	To attract students to secondary or special education teaching	✓	✓	30	\$3,735,000
GTIL Internships	To secure the best students studying to become secondary or special education teachers	✓	✓	30	
Teacher Education Scholarship Program	To attract students in specific Key Learning Areas in hard-to-staff areas (80 places are reserved for Aboriginal students)	✓	✓	300	\$4,501,000
Incentive Scholarship Program	To secure the best graduates in high-demand disciplines before they are engaged by other employers	✓	✓	40	
Enhanced Teacher Training Program	To attract and prepare high quality graduates to teach in primary schools with significant Aboriginal student enrolments	✗	✗	20	
Sponsored Training Education Program	To retrain teachers to increase supply in areas of workforce demand	✓	✓	Uncapped	\$2,080,000
STEM Scholarships for Science and Mathematics	To retrain teachers to increase supply in STEM subjects	✓	✓	80	\$2,471,000
Total					\$13,828,000

Source: Department of Education 2017.

Incentives to teach in hard to staff areas

The Department provides a range of financial incentives for teachers to relocate and practise in rural and remote areas. These include relocation subsidies, retention benefits, additional professional learning days, and a priority transfer scheme to secure a teaching position in a location of choice after three years of service. The Department announced enhancements to the incentives provided to teachers in rural and remote locations from 1 January 2019. These were not assessed in this audit.



2. Monitoring supply and demand



The Department is not accurately tracking the supply and demand for secondary teachers by discipline due to incomplete data.

The Department's current workforce planning model does not accurately predict supply and demand for teachers by discipline and location. An internal review in 2017 acknowledged the limitations of this model. In response the Department developed a new model which it is currently enhancing to address the findings of the review. For this model to be successful, the Department needs to monitor the level of out-of-field teaching and improve data on the willingness of teachers to work in particular locations. Further work also needs to be undertaken to refine the assumptions that underpin the Department's workforce planning models as it starts to predict the need for teachers by discipline.

The Department has not publicly reported on the supply and demand for teachers by discipline since 2015. While it does report annually on its current workforce profile, this information is not detailed enough to inform future strategies or programs. More detailed public reporting may help the Department to influence the future supply of teachers by communicating its projected areas of need. Planned improvements to the Department's workforce planning model, as relayed to us, will add to the data available on areas of need. Once available, this should be reported publicly.

Recommendations

By December 2019, the Department of Education should:

1. Improve its workforce planning model to better understand and communicate supply and demand for teachers by:
 - determining the extent, and analysing the impact, of out-of-field teaching by permanent and temporary teachers in each school
 - sourcing additional data to more accurately reflect teacher location preferences
 - projecting supply and demand by subject level and geographic area
 - regularly reporting on the supply and demand for secondary teachers in each discipline to communicate future areas of need to future teacher education students.

2.1 Collecting accurate data for workforce planning

The Department uses several data sources to understand supply and demand

One key source used to understand the current supply of secondary teachers is the 'Approved to Teach' list. This list details the disciplines teachers are approved in, and the locations they are willing to teach in. The list contains teachers who have indicated that they are actively looking for a long-term teaching position as well as those who are only seeking casual work. The Department has clear procedures to assess applications for approval. It actively removes teachers from the 'Approved to Teach' list who have not taught with the Department in the last five years, do not hold a valid Working With Children Check clearance or do not have current NESA accreditation.

Teachers can update their details on the approved to teach list, including location preferences for permanent appointment, after being granted approval to teach. The Department advised that it encourages teachers to update their personal details and location preferences to assist with its understanding of the future supply of teachers.

However, the 'Approved to Teach' list may not accurately reflect the current supply of teachers. For example:

- the list may include teachers who are no longer seeking permanent employment (for example, they may be currently employed in private schools)
- the recorded location preferences may not accurately reflect where teachers would accept a permanent appointment, because it relies on them keeping their preferences up-to-date.

The Department collects data on student enrolments and completions of teaching degrees to understand future supply. It does this through a yearly census of NSW universities which details the uptake, and completions of teaching degrees in each key learning area. The Department assumes that approximately 80 per cent of teacher education students will apply for approval to teach in Department schools, based on past trends. It could more accurately predict supply by analysing the proportion of teacher education students applying for approval to teach for each key learning area, and at each university. Exhibit 5 details the number of students commencing secondary initial teacher education degrees over the past five years.

Exhibit 5: Commencements of secondary initial teacher education degrees, by key learning area

Key learning area	2013	2014	2015	2016	2017
Science	595	692	584	542	487
Technology and applied studies	281	383	348	350	306
Mathematics	352	377	388	341	371
Non STEM-related disciplines	3,068	3,430	3,016	2,523	2,336

Source: Department of Education 2017.

To understand current and future demand, the Department applies a student to teacher ratio against the Department of Planning's population projections for each local government area. This determines an overall staffing entitlement, not by key learning area. School principals decide how to split this allocation between key learning areas and are not required to report this back to the Department. This means the Department has limited oversight over the level of unmet demand for teachers in specific disciplines.

The Department is not monitoring the extent of out-of-field teaching

The Department does not collate and analyse the data retained by schools to monitor the extent of out-of-field teaching. Out-of-field teaching occurs when permanent or temporary teachers are required to conduct classes outside of their area of expertise. Research suggests that students taught by out-of-field teachers have lower levels of engagement, and this can compromise student learning outcomes.² Several principals we interviewed voiced their concerns over the quality of teachers' content knowledge when conducting classes outside of their discipline.

As part of the audit we distributed a survey to early career teachers across public secondary schools in NSW. Of the teachers who responded to our survey, around one-fifth reported teaching out-of-field for at least five hours per fortnight. Half of these teachers indicated that they do not receive any additional support from their school to teach out of their approved area.

Monitoring the level of out-of-field teaching by permanent or temporary teachers would provide the Department with a more reliable understanding of the disciplines and locations of current demand. It could do this by analysing subject information captured in school timetabling and student attendance programs against the subjects teachers are approved to teach in.

The Department monitors the level of early career teaching across the state

There is a higher proportion of early career teachers approved to teach STEM-related disciplines in remote schools (nearly 40 per cent) compared to metropolitan areas (22 per cent). Past research has shown that early career teachers in NSW suffer higher rates of stress, and are more likely to leave the profession compared to the general teaching cohort.³

² Pike, G, Smart, J, & Ethington, A 2012, The mediating effects of student engagement on the relationships between academic disciplines and learning outcomes - An extension of Holland's theory, Research in higher education, vol. 53, pp. 550–575.

³ Buchanan, J, Prescott, A, Schuck, S, Aubusson, P & Burke, P 2013, Teacher retention and attrition - Views of early career teachers, Australian journal of teacher education, vol. 38, no. 3, pp.112–129.

As part of the Great Teaching, Inspired Learning initiative, the Department provides schools with funding to support induction and professional development programs, including mentoring, for teachers in their first two years of practise. Schools are required to report on how this funding is used in their annual report. In our survey of early career teachers, only 44 per cent of respondents indicated that they had a school-based mentor. Most respondents perceived their school supported the program, but that operational requirements compromised the delivery of mentoring support.

2.2 Workforce planning projections

The current workforce planning model does not project future needs by discipline

The Department uses an aggregate Supply-Demand Model (SDM) to forecast the number of teachers it requires, up to seven years in advance. The SDM estimates demand by applying a student to teacher ratio to the Department of Planning's population projections. Future supply is estimated by applying age-specific separation rates to the existing cohort of teachers. The output of the model shows the overall number of new teachers required to meet future demand.

While the aggregate SDM is useful for forecasting the overall number of teachers required, it:

- does not identify supply and demand at a subject-level, therefore the model cannot predict the number of teachers required for each discipline
- applies the same teacher separation rates to all locations, meaning that it may not accurately represent rural and remote areas.

The Department advised it uses information from the 'Approved to Teach' list and the university census of teacher education students to predict the future supply of new teachers. It assumes that 80 per cent of students will apply for approval to teach in Department schools based on past trends. This enables the Department to predict whether there are likely to be sufficient numbers of teachers available to meet the overall future demand forecast by the SDM.

The new workforce planning model needs further development to address these gaps

Following a review of workforce projections in 2017, the Department developed the Key Learning Area and Subject Teacher Coverage Model (the Coverage Model). This model aims to understand the current, and forecast the future, supply and demand for teachers, by subject and location. The Coverage Model estimates the willingness of teachers to work in particular locations based on the number of applications received previously for a similar position. In principle, this could make the model more reliable for predicting supply in rural and remote areas. However, there are significant limitations in the model. For example it assumes:

- teachers conduct a full-time load in each subject they are approved to teach, meaning the model overestimates availability where a teacher has multiple specialisations
- timetables allow teachers to conduct the maximum number of classes in their subject
- student demand for subjects is common amongst the same geographic areas.

These limitations must be addressed for the model to accurately forecast future supply and demand by subject and location. The Department advised it is sourcing teacher and class timetabling data from schools to strengthen the Coverage Model. This may provide the Department with better information to understand the supply, demand and availability of teachers by both subject and geographic location. The Department plans to share this information with principals and network directors to provide insights into the availability of teachers in their area.

The SDM uses assumptions that are not specific to individual disciplines. The Department will need to refine these assumptions when it transitions to using the Coverage model to forecast future supply and demand. For example, it will need to differentiate the expected number of graduate teachers that will apply to teach with the Department by discipline.

2.3 Reporting on supply and demand

There is a lack of timely and relevant external reporting on the supply and demand for teachers in STEM-related disciplines

Ongoing reporting on the supply and demand for teachers with STEM-related specialities is limited by the absence of reliable discipline-specific data, as detailed in section 2.1. The Centre for Education Statistics and Evaluation (CESE) reports annually on the workforce profile of teachers. The most recent report from 2018 contained data on teachers from 2016. The Department also produces an annual 'Key Statistics' report for its Minister which details the workforce profile. Neither of these reports detail supply and demand for teachers by discipline.

The Department last reported on the supply and demand for teachers by discipline in the 2015 Workforce Supply and Demand Report. This report revealed a decreasing supply of teachers in Mathematics, Physics and Technological and Applied Studies. It also noted that shortages were greater in inland and remote areas.

Planned improvements to the Department's workforce planning model, as detailed above, will add to the data available on areas of need. Once available, the Department should report timely, relevant and accurate information on its workforce needs for teachers in STEM-related disciplines in order to influence the choice of location, or discipline, new teachers choose to practise in.

The Department should report more detailed information to universities of shortages in specific areas

The Department communicates areas of demand to universities via the Deans of Education. It could extend this by liaising more frequently with placement officers and course coordinators in STEM-related disciplines. This would provide the universities with the opportunity to influence the subject choices of its students. While universities we consulted with were aware of general shortages in science and maths, they reported a desire for clearer communications of shortages in specific areas. Universities must report on the post-degree employment of their graduates and therefore have an incentive to direct students into making choices where they are more likely to secure employment.



3. Strategies to attract and retain teachers



The Department's current scholarship and sponsorship programs are not allocating all available places and many scholars withdraw from the programs before completion. An internal review in 2017 raised several issues with the effectiveness of programs and the Department has started to revise its scholarship, sponsorship and incentive programs.

An internal review in 2017 highlighted that scholarship and sponsorship programs were not targeting workforce need, and that there were no key performance indicators to determine the overall effectiveness of these strategies. In addition, the review found that only 79 per cent of available scholarship placements are allocated each year, and 31 per cent of scholarship recipients withdraw prior to completing their required service period. The Department recently announced changes to its scholarship programs from 2019 onwards.

The Department has incentives to encourage teachers to work in rural and remote areas, including teachers in STEM-related disciplines. Incentives include access to priority transfers, rental subsidies and other allowances. Research conducted in 2016 examined the influence of incentives in encouraging teachers to work in rural and remote areas. The Department used findings of this research when updating its set of rural and remote incentives in 2017.

The Department promotes its scholarship and sponsorship programs through the teach.NSW website. It uses social media to direct applicants to this website. It also promotes its programs through careers fairs, University open days, and professional events. Past applicants have reported that the website clearly communicates eligibility criteria and the terms of agreement for all scholarship programs.

The Department could strengthen its relationship with universities to attract teachers to areas of need by collecting and analysing data on practicum placements, facilitating placements for scholarship recipients, and communicating predicted teacher needs by discipline.

Recommendations

By December 2019, the Department of Education should:

2. Implement changes to address the findings of the 'Teacher Scholarship Realignment' report, including by:
 - testing a range of program designs with target candidates to determine the best options to attract more suitable applicants
 - establishing key performance indicators, and setting targets, to better monitor the effectiveness of the programs
 - reducing the number of scholars appointed to over-establishment positions
 - increasing the proportion of scholars appointed to priority locations
 - further analysing scholarship recipients career paths to inform future improvements to the scholarship programs.
3. Review its role in the practicum placement process of pre-service teachers by:
 - analysing how many students each school accommodates per year, to ensure there are appropriate placements available for students in high needs disciplines
 - working with universities to facilitate practicum placements for scholarship recipients
 - establishing mechanisms for ongoing monitoring of its partnerships with universities to ensure they are meeting their aims.

3.1 Development of strategies

Scholarships and incentives aim to attract teachers to practise in areas of demand

Many of the Department's scholarship programs were developed to fulfil government commitments to attract teachers in hard to staff disciplines and locations (see Exhibit 4). Hard to staff locations include rural and remote areas, as well as some parts of Western and South-Western Sydney. The Department has not defined a threshold to classify hard to staff locations. It advised that it plans to use the enhanced coverage model to more accurately identify areas of need in the future.

Most of the incentives provided to teachers in rural and remote areas were developed as part of the rural and remote strategy. This strategy aims to 'attract experienced and highly accomplished teachers and support the continued improvement of students' outcomes in rural and remote schools'. Many of the incentives were designed to address common concerns about teaching in rural and remote locations and to make it more appealing to established teachers.

The Department consulted with stakeholders to enhance its Rural and Remote Strategy

The Department engages with stakeholders when reviewing its strategies and scholarships. It consulted with stakeholders for phase 2 of the Rural and Remote Strategy in 2017. This strategy aims to attract quality teachers to work in hard to staff areas, including those approved to teach in STEM-related disciplines. The Department invited key stakeholders to give written feedback on the proposed changes. It also informed universities of the implications of proposed changes for pre-service teachers. Formally involving these stakeholders gave the Department insight into how the strategy would be perceived by the sector once released.

The teach.Rural scholarship was enhanced by feedback received from pre-service teachers. This scholarship was originally targeted to encourage Year 12 students entering a teaching degree to practise in a rural or remote location. While promoting its scholarships at careers exhibitions, many pre-service teachers expressed interest in the program, however were ineligible. The Department expanded the eligibility criteria for the program in 2018 to include pre-service teachers. This increases the number of potential applicants and further promotes teaching in rural and remote locations to pre-service teachers closer to accreditation.

The Department used research to enhance its Rural and Remote Strategy

The Department initiated research projects to support the incentives provided under the revised Rural and Remote Strategy. In 2016, it initiated a research project to gauge the influence that many potential incentives would have on a teacher's intentions to work in a rural or remote school. The incentives that had the most influence on the teachers surveyed were guaranteed priority transfers, additional recurring financial incentives and rental subsidies. These areas mirror incentives to be provided under the revised Rural and Remote strategy.

In 2017, the Department partnered with the Department of Premier and Cabinet's Behavioural Insights Unit (BIU) to understand ways to encourage pre-service teachers towards practicum training in a rural or remote area. Research suggests that a brief exposure to teaching in a rural or remote community can influence teachers' attitude toward seeking a permanent position in these areas.⁴ The BIU partnered with three universities to run trial programs. It found the most effective method was to provide pre-service teachers with personalised promotional material clearly communicating the pro-social and career enhancing opportunities of teaching in a rural setting.

Difficulties finding practicum placements for students in STEM-related disciplines

Some universities we consulted shared difficulties in finding schools willing to host placements for their students, even in high-demand disciplines. Practicum placements allow the pre-service teacher to observe, and gain experience in, face-to-face classroom teaching at various stages throughout their training. The Department does not collect or analyse information on practicum placements to monitor whether sufficient places are available for high-demand disciplines.

⁴ Halsey, R 2009, Australia's sustainability: a new policy front for rural education? Education in rural Australia, vol. 19, no. 2, pp 11–22.

In 2015, the Department entered into partnerships with all NSW universities to improve the practicum experiences of pre-service teachers in disciplines of need. The partnerships involved modelling better practice practicum placements at selected 'hub' schools. While the universities we consulted found this arrangement assisted them to connect with schools, most hub schools only accept limited numbers of placements in STEM-related disciplines.

Students on teach.Rural Scholarships must complete a practicum placement in a rural or remote area. Some universities reported difficulties finding placements to meet these requirements. This is due to suitable schools being beyond their typical placement areas, as well as not being informed which of its students are on scholarships. The Department should work with universities to ensure that teach.Rural Scholarship recipients can access practicum placements.

The Department advised that it is revising its partnerships with NSW universities to facilitate practicum placements from 2019. These plans include:

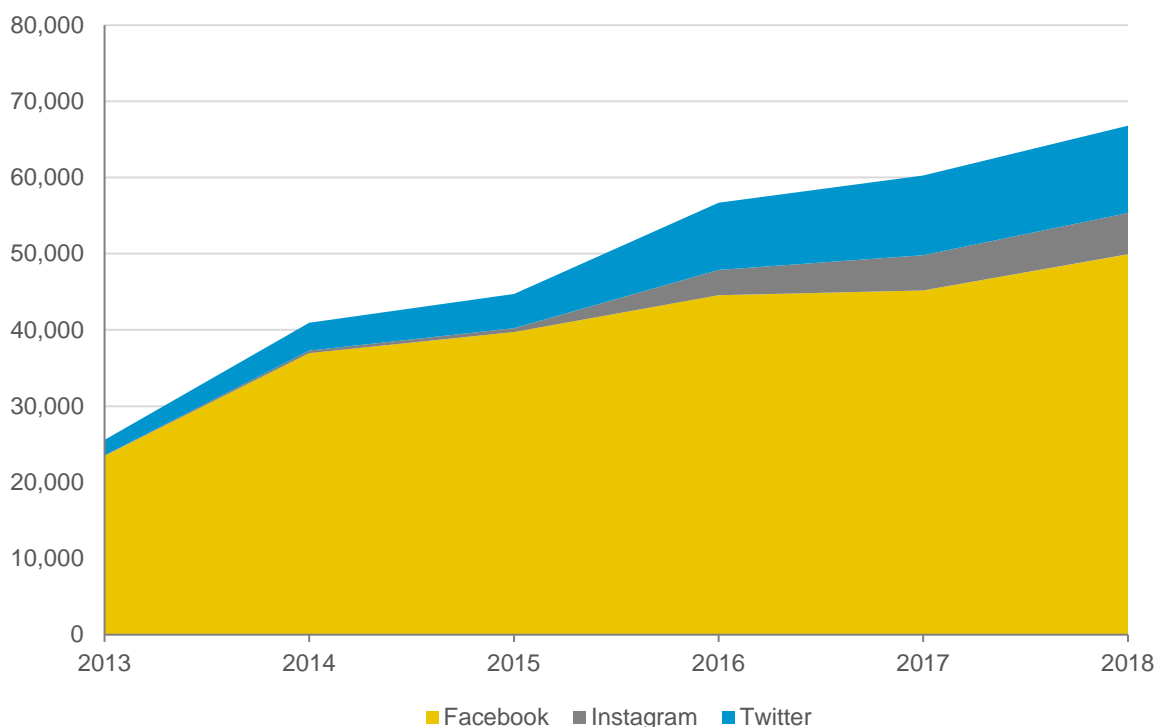
- reviewing the current pool of hub schools to assess whether they have met their objectives
- establishing a 'STEM Professional Experience Hub School' to provide additional practicum placements for STEM-related disciplines
- requiring universities to provide data on the number, location and subject area of practicum placements in Department schools.

3.2 Communication of strategies

The Department effectively promotes its scholarship and sponsorship programs

The Department has met the majority of its 'success measures' for promoting scholarship and sponsorship schemes. These measures relate to the reach of its digital promotions, the number of applications received, and positive feedback on the experiences of past applicants. The Department has increased the amount of applications received for four out of the five main scholarship programs. It has also increased the number of followers on all social media channels (see Exhibit 6).

Exhibit 6: Number of followers on teach.NSW social media channels



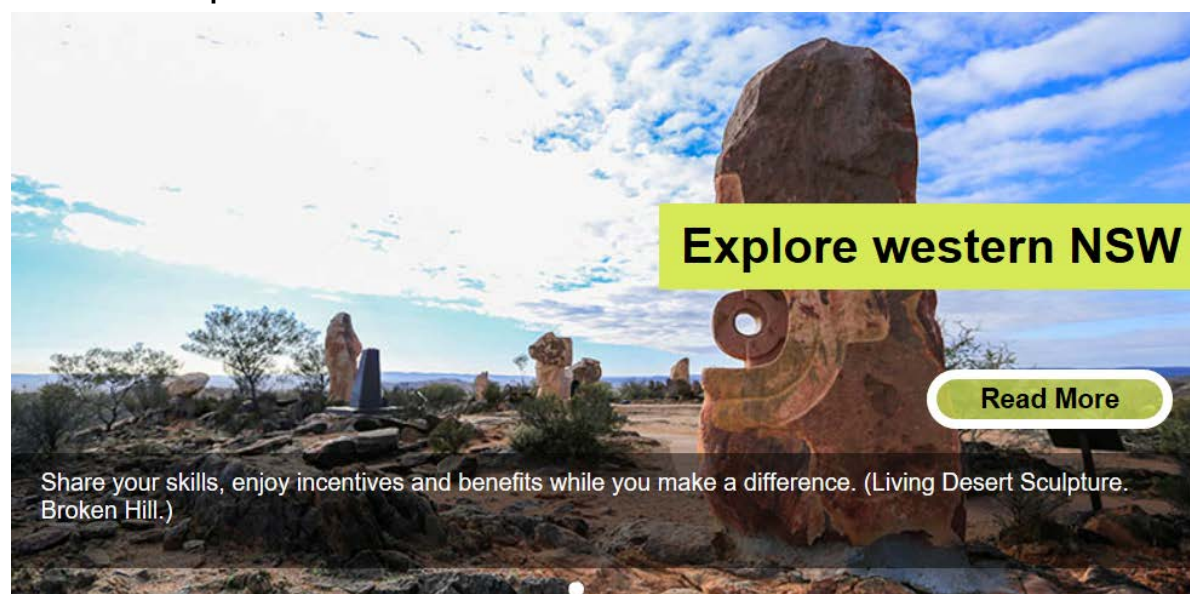
Source: Department of Education 2018.

The Department's digital strategies use social media channels to direct the target audience to the teach.NSW website, which is maintained as the 'source of truth' for all programs. The number of views of this website has increased over time. Every year, the Department surveys scholarship applicants for feedback on the advertisement and program application process. According to the most recent survey, 73 per cent of respondents found it easy to locate information on the programs, and 72 per cent clearly understood the eligibility criteria for each program from the information on the teach.NSW website.

The Department has used research and feedback to target communications

The Department has tailored promotion of the scholarship programs from research and feedback from past applicants. In 2016, the Department commissioned a university to investigate ways to encourage teachers to practise in a rural or remote location. One strategy suggested was to promote the ability to make a positive impact on a rural town. The most recent survey of scholarship applicants also indicated that a major motive for entering the teaching profession was to make a difference in the lives of students. The Department modified its promotions of the teach.Rural program accordingly (Exhibit 7).

Exhibit 7: Example of a recent teach.Rural advertisement



Source: Department of Education 2018.

The Department promotes its scholarships at university events

The Department promotes its scholarships and incentives to pre-service teachers at universities across the state. In 2018, it attended 58 events across 13 universities. At the events, staff distribute promotional material and field questions from potential applicants. Many universities we consulted with told us they would welcome further opportunities for the Department to inform their students of the scholarships and incentives available and application processes.

The Department hosts question and answer forums on social media to increase reach to students who were unable to attend university events. These forums are recorded and available on the Department's social media pages. Since August 2017, the Department has held three forums focused on the scholarship programs and graduate employment. These events combined recorded approximately 14,500 views.

3.4 Effectiveness of strategies

Recent reviews identified significant shortcomings of scholarship programs

In 2016, the Department reviewed its Teacher Education Scholarship programs. This prompted a wider review of all scholarship and sponsorship programs in 2017. These reviews found that:

- some programs are not targeting workforce needs
- there are no targeted outcomes, or key performance indicators for any program
- approximately 20 per cent of program places are not being awarded each year as a result of the quality of applications received
- scholarship recipients are appointed to positions outside areas of demand (59 per cent of scholars were appointed to metropolitan areas)
- around one in seven scholarship recipients are appointed 'over establishment'
- 30 per cent of Teacher Education Scholarship recipients withdraw from their program before being appointed to a school, and a further nine per cent do not complete the required three years of service
- programs are not facilitating mid-career transitions into teaching
- tracking of scholarship recipients could be improved to understand future career success.

The 2017 review identified the need to refocus the scholarships strategy to make a demonstrable contribution towards attracting more teachers to practice in disciplines, and locations of need. The review suggested that the current offerings were not attracting the desired number of high-quality applicants.

The Department advised it is revising its scholarship and sponsorship offerings to address the findings of these reviews. In October 2018, the Department announced additional scholarships to encourage STEM professionals to become teachers. These new scholarships were not assessed as part of this audit.

Not all available scholarships are allocated and many teachers withdraw

Over the past few years, the Department has awarded 79 per cent of the available places in its scholarship and sponsorship programs, as shown in Exhibit 8. The Department advised that the rate of placement reflects the number of applicants who have met or exceeded the selection criteria. It advised that it is revising its scholarship offerings for 2020 to increase the attractiveness of the incentives to higher quality applicants.

There are over 530 scholarship and sponsorship places on offer each year to attract secondary teachers to practise in high needs areas. Since 2013, around 30 per cent of scholarship recipients in STEM-related disciplines have been appointed outside of these areas.

Exhibit 8: Scholarship and sponsorship placement

Program	Places available	Applications per year (average)	Places awarded per year (average)	Withdrawal per year (average)
Teach.Rural	50	172	45 (90%)	4 (9%)
GTIL Cadetships	30	99	23 (77%)	5 (20%)
GTIL Internships	30	103	24 (80%)	4 (15%)
Teacher Education Scholarship Program	300	644	250 (83%)	98 (39%)
Incentive Scholarship Program	40	68	26 (65%)	4 (17%)

Program	Places available	Applications per year (average)	Places awarded per year (average)	Withdrawal per year (average)
Sponsored Training Education Program	Not capped	92	55 (N.R%)	10 (18%)
STEM Scholarships for Science and Mathematics	80	127	53 (66%)	(N.R)
Total	530*	1,213*	421 (79%)*	116 (31%)* **

* Does not include figures for the Sponsored Training Education Program.

** Does not include figures from STEM Scholarships for Science and Mathematics.

N.R Not recorded.

Source: Department of Education 2016 and 2017.

Around 30 per cent of recipients withdraw from the program before completing their mandatory three-year service period in an agreed location. When a scholarship recipient withdraws, the Department seeks reimbursement for funds paid. In 2016, the Department surveyed scholarship recipients to better understand the reasons why teachers withdraw from the programs.

The Department advised that it plans to conduct yearly surveys of scholarship recipients to better support recipients throughout the term of their scholarship, from 2019. It should use the insights gained from this survey to improve its scholarship programs to better address areas of workforce need.

In 2017, the Department partnered with a university to better understand the common qualities of successful teachers in NSW. The Teacher Success Profile identifies the specific academic qualifications and a range of non-academic factors that help predict the success of a teacher in NSW public schools. The Department advised that it has used these learnings to revise its assessment and selection process for scholarship applicants for the 2019 intake. Scholarship applicants are now required to undertake a more robust assessment process, aligned to the teacher success profile, which is designed to improve scholarship completion and retention rates.

There are no key performance indicators to monitor scholarships and sponsorships

In 2017, an internal review of the scholarship and sponsorship programs found that the success of the Department's initiatives was not being effectively monitored so it was difficult to assess if the programs are helping to address areas of shortage. The review recommended that the Department develop key performance indicators, and set appropriate targets, to facilitate effective monitoring.

Setting key performance indicators would allow the Department to assess the effectiveness of its schemes in meeting their objectives. While the key performance indicators should be program-specific, common indicators could be:

- percentage of scholarships allocated
- percentage of recipients completing their teacher education training
- university grades of scholarship recipients
- percentage of recipients accepting appointments in line with their agreements
- percentage of recipients fulfilling the service term of their agreement
- percentage of recipients teaching five years after the completion of their service term.

After establishing the key performance indicators, the Department should set yearly targets to determine the effectiveness of its programs. The Department already collects most of the data needed to report against key performance indicators. It could analyse past performance to set appropriate targets for future years.

Section two

Appendices



Appendix one – Response from agency



Ms Margaret Crawford
Auditor-General of NSW
GPO Box 12
SYDNEY NSW 2001

DGL18/1044

Via email: claudia.migotto@audit.nsw.gov.au

Dear Ms Crawford

Thank you for your letter of 17 December 2018, providing me with a copy of the final report for the Performance Audit – Supply of secondary teachers in STEM-related disciplines.

Please find attached the Department of Education's formal response to the report.

The department is strongly committed to ensuring that, through the provision of quality teaching by appropriately qualified teachers, all students in NSW public schools have access to high quality learning across STEM subjects, particularly science and mathematics.

The department welcomes the Auditor-General's performance report as an opportunity to reflect on the challenges faced in attracting and recruiting high quality STEM teachers across all NSW public secondary schools, as well as acknowledge the positive work that is already underway by the department to address these issues.

The department accepts all recommendations in the report and is pleased to advise that progress is already being made to address the three key recommendation areas relating to workforce planning, scholarship strategies and practicum placements for pre-service teachers. As such, the department anticipates that all recommendations will be addressed within the prescribed timeframe.

I would like to take this opportunity to thank the officers from the Audit Office of NSW who conducted this review, and also recognise the officers within the department who provided assistance.

Yours sincerely

Mark Scott AO
SECRETARY
DEPARTMENT OF EDUCATION
14 January 2019

NSW Department of Education

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The NSW Department of Education welcomes the NSW Auditor-General's Performance Audit report on the supply of secondary teachers in STEM-related disciplines

The department is strongly committed to ensuring the provision of a high quality education across STEM (science, technology, engineering and mathematics) for all NSW public secondary school students, and acknowledges that paramount to this is the attraction and recruitment of appropriately qualified STEM teachers. While there are many outstanding STEM teachers currently working across NSW public secondary schools, the department is aware that there are certain areas of location and discipline shortage, and more must be done to ensure that the supply of STEM teachers will meet current and future demands.

The department is pleased that the report has acknowledged the positive work that is already underway to address many of the issues highlighted by the report, as well as the high quality promotional activities undertaken by the department to promote teaching as a career of choice.

The department accepts all recommendations of the report and will implement the recommendations.

Monitoring supply and demand

The report has identified current shortcomings in the department's capacity to accurately predict workforce supply and demand, resulting in limitations in understanding where there may be a deficiency in the provision of appropriately qualified STEM teachers, and the subsequent planning that could occur to meet this need.

While the department reports annually on the workforce profile of teachers, the department will undertake more detailed and timely public reporting which will help the department to influence the future supply of teachers by communicating its projected areas of need.

The department has taken significant steps over the past few years to improve its workforce planning and analytic capability, moving from an aggregate model of supply-demand to a coverage model which seeks to understand supply-demand by subject area and location. Further work still needs to be undertaken to test and refine the assumptions that underpin the department's coverage model to ensure accurate projections and to better inform workforce management strategies.

In 2017 the department implemented a new workforce planning model, *Key Learning Area and Subject Teacher Coverage Model* (the 'Coverage Model') to better understand the supply, demand and availability of teachers by both subject and geographic location. This model was built from person and position records, rather than the broad trends that were used in previous workforce planning models. This new approach resolved the issues of observing supply and demand in small areas of the state and for the first time enabled the department to assess the availability of teachers by subject and location down to an individual school.

In 2018 the department endorsed the next generation of the Coverage Model after beginning to source additional data from schools about teacher and class timetabling. This project aims to test and resolve the assumptions that underpin the next generation Coverage Model, improving its precision. This will provide access to principals and network directors giving them visibility and insights into the availability of teachers in a school's area and improve tactical and strategic workforce management. This model will enable greater visibility at a school level of teaching supply and demand by subject, including out-of-field teaching where teachers are teaching subjects other than those in which they have specialised.

Strategies to attract and retain teachers

The report has focused on the department's scholarship and sponsorship programs as a primary strategy to assist in attracting and retaining STEM teachers to locations of workforce need. The report has found that the existing programs are not maximising opportunities for addressing supply and demand issues.

In 2017, the department initiated and completed an extensive review of current offerings under the scholarship and sponsorship programs to inform a refresh of these strategies and recommend key changes to the range of offerings. The outcome of this review was outlined in the Scholarship Refresh Strategy Paper, which included reference to two new programs to attract and retain STEM teacher candidates. The Teach.Now and Teach.STEM scholarships were subsequently announced by the Minister for Education and the Premier in October 2018 as part of the NSW government's Mathematics Strategy, and were therefore out of scope for the current report. These new programs will more explicitly target STEM industry professionals and high achieving final year STEM university students who are interested in converting to a career in teaching, with the programs offering a substantial financial package of support during the period of study. It is anticipated that the introduction of these scholarships will see a significant improvement in the retention of STEM scholars throughout their study and successful appointment to a STEM teaching position.

The department continues to work with University partners to enhance practicum opportunities. The department is finalising Professional Experience Agreements with Initial Teacher Education Providers (ITEPs) for 2019-2021. Amendments to these agreements include a requirement for the ITEPs to provide the department with data in relation to the number, location and subject area of teacher education students (TES) undertaking professional experience placements in departmental schools annually.

As identified in the report, the department is aware that some ITEPs have had difficulties placing STEM teacher education students in appropriate settings. In response to this notification and to address identified departmental workforce needs, a STEM Professional Experience Hub School will be trialled in 2019. This trial will enable targeted placements for STEM scholarship and sponsorship recipients with STEM related mentoring and professional development support available for Hub school teachers to enhance the professional experience for STEM teacher education students. All ITEPs will be able to access the STEM Professional Experience Hub for their STEM teacher education students, ensuring appropriate placements for these students as part of their teacher education studies.



Appendix two – About the audit

Audit objective

This audit assessed the effectiveness of the Department of Education's workforce plans and strategies in responding to the demand for secondary teachers in STEM-related disciplines.

Audit criteria

We addressed the audit objective with the following lines of enquiry:

1. How well does the Department track the supply of, and demand for, secondary teachers in STEM-related disciplines across NSW?
 - The Department has accurate data on the supply of, and demand for secondary teachers and the extent of out-of-field teaching in STEM-related disciplines.
 - The Department uses a robust workforce planning model to understand future needs.
 - The Department reports on current, and predicted shortages of secondary teachers in STEM-related disciplines.
2. Does the Department have effective strategies to attract and retain secondary teachers in STEM-related disciplines?
 - Strategies are informed by predicted needs, stakeholder consultation, research and evidence.
 - The Department has established clear objectives and appropriate key performance indicators to monitor the effectiveness of its strategies, incentives and programs.
 - Incentives and programs are targeted to areas of need and are clearly communicated to maximise participation.
 - The Department regularly reviews the effectiveness of its incentives and programs and makes improvements to programs.

Audit scope and focus

In assessing the criteria, we examined the Department's:

- workforce planning models, plans and strategies
- processes to collect information to inform, and conduct, its workforce planning
- incentive, and support programs, offered to university students and qualified teachers to encourage teachers to practice in high-need areas and disciplines
- support programs for early career teachers in STEM-related disciplines.

Audit exclusions

The audit did not:

- assess the current, or future, supply of special education teachers, primary school teachers, vocational education and training teachers, or school counsellors
- assess student participation and results in STEM-related subjects
- examine accreditation of Initial Teacher Education or professional development courses
- question the merits of government policy objectives.

Audit approach

Our procedures included:

1. Interviewing:
 - staff from the Department involved in:
 - the approval and placement of qualified teachers
 - workforce planning
 - the development of scholarship and sponsorship programs
 - the allocation of scholarship and sponsorship places
 - promoting the scholarship and sponsorship programs
 - 9 school principals from central and secondary schools across the state
 - staff from nine universities responsible for co-ordinating secondary teaching degrees and practicum placements.
2. Distributing a survey to secondary school teachers eligible for early career funding (those in their first five years of a permanent position). We received 466 responses to this survey.
3. Examining:
 - the Department's workforce planning models, underlying data and assumptions
 - documentation detailing the Department's strategies to attract teachers to practise in hard to staff locations and disciplines
 - any relevant reports on the supply and demand for secondary teachers.

The audit approach was complemented by quality assurance processes within the Audit Office to ensure compliance with professional standards.

Audit methodology

Our performance audit methodology is designed to satisfy Australian Audit Standard ASAE 3500 Performance Engagements and other professional standards. The standards require the audit team to comply with relevant ethical requirements and plan and perform the audit to obtain reasonable assurance and draw a conclusion on the audit objective. Our processes have also been designed to comply with requirements specified in the *Public Finance and Audit Act 1983* and the *Local Government Act 1993*.

Acknowledgements

We gratefully acknowledge the co-operation and assistance provided by the Department of Education. In particular, we wish to thank our liaison officers and staff who participated in interview and provided material for the audit.

We would also like to thank other stakeholders that spoke to us and provided material during the audit.

Audit cost

Including staff costs, travel and overheads, the estimated cost of the audit is \$296,000.



Appendix three – Performance auditing

What are performance audits?

Performance audits determine whether state or local government entities carry out their activities effectively, and do so economically and efficiently and in compliance with all relevant laws.

The activities examined by a performance audit may include a government program, all or part of an audited entity, or more than one entity. They can also consider particular issues which affect the whole public sector and/or the whole local government sector. They cannot question the merits of government policy objectives.

The Auditor-General's mandate to undertake performance audits is set out in section 38B of the *Public Finance and Audit Act 1983* for state government entities, and in section 421D of the *Local Government Act 1993* for local government entities.

Why do we conduct performance audits?

Performance audits provide independent assurance to the NSW Parliament and the public.

Through their recommendations, performance audits seek to improve the value for money the community receives from government services.

Performance audits are selected at the discretion of the Auditor-General who seeks input from parliamentarians, state and local government entities, other interested stakeholders and Audit Office research.

How are performance audits selected?

When selecting and scoping topics, we aim to choose topics that reflect the interests of parliament in holding the government to account. Performance audits are selected at the discretion of the Auditor-General based on our own research, suggestions from the public, and consultation with parliamentarians, agency heads and key government stakeholders. Our three year performance audit program is published on the website and is reviewed annually to ensure it continues to address significant issues of interest to parliament, aligns with government priorities, and reflects contemporary thinking on public sector management. Our program is sufficiently flexible to allow us to respond readily to any emerging issues.

What happens during the phases of a performance audit?

Performance audits have three key phases: planning, fieldwork and report writing.

During the planning phase, the audit team develops an understanding of the audit topic and responsible entities and defines the objective and scope of the audit.

The planning phase also identifies the audit criteria. These are standards of performance against which the audited entity, program or activities are assessed. Criteria may be based on relevant legislation, internal policies and procedures, industry standards, best practice, government targets, benchmarks or published guidelines.

At the completion of fieldwork, the audit team meets with management representatives to discuss all significant matters arising out of the audit. Following this, a draft performance audit report is prepared.

The audit team then meets with management representatives to check that facts presented in the draft report are accurate and to seek input in developing practical recommendations on areas of improvement.

A final report is then provided to the head of the audited entity who is invited to formally respond to the report. The report presented to the NSW Parliament includes any response from the head of the audited entity. The relevant minister and the Treasurer are also provided with a copy of the final report. In performance audits that involve multiple entities, there may be responses from more than one audited entity or from a nominated coordinating entity.

Who checks to see if recommendations have been implemented?

After the report is presented to the NSW Parliament, it is usual for the entity's audit committee to monitor progress with the implementation of recommendations.

In addition, it is the practice of Parliament's Public Accounts Committee to conduct reviews or hold inquiries into matters raised in performance audit reports. The reviews and inquiries are usually held 12 months after the report received by the NSW Parliament. These reports are available on the NSW Parliament website.

Who audits the auditors?

Our performance audits are subject to internal and external quality reviews against relevant Australian and international standards.

The Public Accounts Committee appoints an independent reviewer to report on compliance with auditing practices and standards every four years. The reviewer's report is presented to the NSW Parliament and available on its website.

Periodic peer reviews by other Audit Offices test our activities against relevant standards and better practice.

Each audit is subject to internal review prior to its release.

Who pays for performance audits?

No fee is charged for performance audits. Our performance audit services are funded by the NSW Parliament.

Further information and copies of reports

For further information, including copies of performance audit reports and a list of audits currently in-progress, please see our website www.audit.nsw.gov.au or contact us on 9275 7100.

OUR VISION

Our insights inform and challenge government to improve outcomes for citizens.

OUR PURPOSE

To help parliament hold government accountable for its use of public resources.

OUR VALUES

Purpose – we have an impact, are accountable, and work as a team.

People – we trust and respect others and have a balanced approach to work.

Professionalism – we are recognised for our independence and integrity and the value we deliver.

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