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Australian Skills Classification Methodology

**November 2023**

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# Introduction

### Why look at skills instead of occupations?

The labour market is evolving. Job tasks are changing, new jobs are emerging and some jobs are declining. As the labour market continues to shift in response to factors like globalisation, automation, technological innovation and demographic change, an understanding of changing skills needs will be critical to help ensure that Australians are equipped with the relevant skills, knowledge and experience to continue to thrive at work.

#### Job tasks are changing

There are divergent views about the future of work and whether robots will eventually take our jobs but there is more broad-scale agreement that the tasks within jobs are changing.

For example, a modern paralegal spends less time in law libraries and more time searching digital legal research repositories than paralegals of days gone by. Similarly, legal documents may be electronically filed and submitted – saving lengthy trips to lodge them at the courthouse.

Both these examples have implications for the digital literacy required for the profession – a trend that is mirrored across many other occupations in the labour market – but also for the time spent on certain types of tasks and the structure of a typical workday. What hasn’t changed for this occupation is the requirement for sound knowledge of legal terminology and procedure, as well as excellent organisational, communication, research and writing skills.

By understanding and talking about jobs at the level of their skills, and how these are changing, we unlock a deeper level of understanding of the labour market and skills supply and demand. This changes the statement from “we need paralegals” to “we need paralegals with these critical skills”. This helps:

* employers to articulate and recruit for the skillsets they really need
* individuals to identify training and development opportunities to help them continue to thrive in a changing labour market
* workforce planners to identify critical skills gaps and where these may be filled by an existing workforce or up- or re-skilling initiatives
* policymakers to better understand critical skills gaps in the labour market and how these could be addressed.

## Since the first release

### Expansion and improvement

Since its initial release as a beta product in March 2021 with only 600 occupations the Classification has been improved and expanded to cover more of the occupations and skills in the Australian labour market. Significant milestones in this process have included:

* removal of the beta label to signify the structure and approach to the Classification has been confirmed
* achieving greatly increased coverage of the Australian labour market including the incorporation of emerging occupations such as respiratory scientists and technicians, DevOps engineers, and solar installers
* ongoing work to better reflect important knowledge and capability relating to culture, diversity, and inclusion into the Classification
* the release of the [Skills Transition dataset](https://www.jobsandskills.gov.au/australian-skills-classification#similarity) which uses the Classification to quantify the degree of similarity between occupations based on their underlying skills
* productive and collaborative stakeholder engagement in order to make improvements to the classification and to support its usage in tools and analysis.

### The Classification in practice

The initial release of the Classification occurred in a period of accelerated workforce change due to the COVID-19 pandemic.

The pandemic undoubtably brought more incentives for businesses and sectors to adopt new technologies, update systems, diversify their markets, products or services and change their working arrangements or delivery models.

It also meant that some individuals required greater support to identify and make job transitions, and this is reflected across some of the use cases we saw for the Classification during this period. For example the Classification data was used to:

* underpin the Jobs in Demand by Location tool on the Australian Government’s Jobs Hub that allowed users to search jobs by location, skills in demand, jobs that match their skills and jobs that require similar skills
* power the Department of Employment and Workplace Relations’ Find A Role Tool that supported jobactive providers to help match job seekers with opportunities that match their skills and identify training needs.

Other uses of Classification data have included:

#### Powering policies and programs

* Core competency data has been used for employability assessments under the Skills Assessments Pilots to help recognise the valuable skills migrants bring with them and their ability to contribute to the Australian workforce.
* The South Australian Department for Innovation and Skills utilised occupation-to-occupation similarity data and VET course recommendations to input into a review of the department’s VET course subsidy allocation process.
* The Australian Public Service Commission utilised occupation-to-occupation similarity data to inform Australian Public Service wide workforce planning.
* The then Victorian Department of Jobs, Precincts and Regions utilised occupation-to-occupation similarity data to inform Victorian Government programs for unemployed workers, and industry advice to support economic recovery and structural changes.

#### Enabling skills reporting and analysis

* The Reskilling Australia report (2019, Department of Employment, Skills, Small and Family Business) used Classification data to outline the first Australian model to map how similar one job is to another based on skills.
* Australia’s Welfare 2019: data insights (2019, Australian Institute of Health and Welfare) used Classification data to outline the potential impact of automation on jobs
* The Australian Treasury utilised occupation-to-occupation similarity data to inform estimates of training required to transition between occupations in their macroeconomic model.
* The State of Australia’s Skills 2021: now and into the future (2021, National Skills Commission) utilised Classification data:
	+ as one data input to create the first economy-wide map of the skills clusters used by employed and unemployed workers in the labour market
	+ to highlight transition options and transferable skills across occupations
	+ combined with five-year employment projections to create five-year skills projections
	+ to show emerging and trending skills in the labour market
	+ to measure automatability in the labour market.
* Australia’s current, emerging and future workforce skills needs (2022, National Skills Commission) utilised Classification data to:
	+ map to employment projections to identify projected skills growth and emerging skills needs
	+ combine with five-year employment projections to create five-year skills projections
	+ identify ‘green skills’ within occupations to help identify the occupations, industries, and skills Australia has and will need as we move forward to address climate change
	+ analyse skill trends in the labour market relating to digital skills, automatability, the ‘human dimension’ of work, and the ‘five Cs’ – Care, Computing, Cognitive Abilities, Communication, and Climate.

#### Underpinning digital and other enabling tools

* Classification data was used to underpin the Australian Government’s:
	+ Skills Match tool which matched current skills and experiences to training and career pathways (since decommissioned and replaced by other tools)
	+ Explore Australia tool giving information on the skills demanded by employers for jobs at a regional level (since decommissioned and replaced by other tools)
	+ Job Switch Tool, that helps job seekers identify jobs they already have skills for, find jobs in demand, how similar they are to jobs they have done before, and available jobs in their location.
* The NSW Department of Education utilised occupation-to-occupation similarity data and VET course recommendations for an app (NSW Skills Hub) to enable phone centre staff to provide more tailored advice to job seekers.

# Understanding the Classification

## What is the Australian Skills Classification?

The Australian Skills Classification (the Classification) provides the basis for turning an occupation-based view of the economy into a skills-basedview.

It maps the skills used within occupations, providing a ‘common language’ of skills where things like occupation titles and qualifications have long been used as proxies.

By systematically setting out the skills required for Australian occupations, the Classification adds a new layer of information to existing data about occupations or qualifications—improving the way we analyse the skills in our labour market, and how we respond to issues of skills supply and demand.

## Structure of the Australian Skills Classification

The Classification sets out three categories of skills for occupations – Core Competencies, Specialist Tasks and Technology Tools.



### Core competencies

Core competencies are skills that are common to all jobs such as ‘teamwork’ or ‘problem solving’. They are sometimes known as ‘foundation skills’ or ‘employability skills’. The core competencies in the Australian Skills Classification align to the definitions of foundation skills typically used in the Australian VET system – specifically the Employability Skills Framework developed by the Australian Skills Quality Authority with minor differences recommended by education system experts.

A 10-point scale is used to describe the competency required for a core competency within an occupation. Each value has corresponding description to explain what it means. These definitions are general and not specific to occupations.

The skills classification offers researchers, governments, industry, education and training sectors a common way to identify, measure, assess or compare core competencies. This can help to focus and align efforts to develop core competencies in high demand.

The classification of core competencies also makes it possible to consider their role in the development and application of transferable skills. Core competencies are as important to skill transferability as specialist tasks. For example, businesses may need workers with technical skills, but they may not be productive without core competencies such as oral communication, teamwork or problem solving.

### Specialist tasks

Specialist tasks these are the activities that describe day-to-day work in a job – for example ‘preparing financial documents’ or ‘giving immunisations’. While specialist tasks can be transferrable across occupations and sectors, they are not universal - unlike core competencies.

As such, specialist tasks are useful for differentiating occupations. Specialist tasks change more frequently than core competencies, making it possible to identify trends. This information adds to our understanding of how jobs may be changing in response to factors like increased digitisation or changing business models.

Industry and employers can use the specialist tasks to define critical skills and identify skill gaps that could be met by learning on the job, short courses or accelerated training.

Governments and education and training sectors can also use this as an additional source of information to identify further opportunities to develop timely and targeted short courses or adapt curriculum.

#### Skills clusters and Skills Cluster families

The specialist tasks have been grouped together with similar specialist tasks into skills clusters, and again into skills cluster families. Tasks within a cluster are broadly transferable – the idea is that if you can do one task in the cluster, you can likely do the others (noting that regulatory, licencing or qualification restrictions may apply).

Skills clusters illustrate a new way of thinking about skills and how they are similar to each other outside of the context of occupations. They also make the Classification a true taxonomy of skills, rather than an occupation driven taxonomy which includes skills.

This way of thinking about similar skills has applications for skills gap analyses – providing a way of determining whether an already identified skills gap is similar or quite different from the existing skills supply, and whether a skills gap can be met by an existing workforce. This also has applications for the development of training and education packages in terms of skills that could be taught together or increased return on investment for training.

### Technology Tools

Technology tools are the software and hardware used in occupations – for example ‘graphics or photo imaging software’.The technology tools describe software and equipment types or categories and provide specific packages or products as examples.

Understanding the technology tools required in occupations, and how these are changing, can help inform decisions about training, up-skilling and re-skilling, or how to take advantage of emerging technologies across different fields and industries.

### Specialisations

In March 2022 specialisations were added to the Classification. Specialisations are commonly used titles which refer to a subset of jobs belonging to an ANZSCO 6-digit occupation. These jobs involve the performance of more specific tasks in addition to some or all of the broader range of tasks usually performed in the occupation.

As the Classification is industry-agnostic, specialisations help us bring in important contextualising information that reflect the specific contexts in which some work is undertaken – and help stakeholders across sectors see their occupations and skills better reflected in the Classification.

It is important to note that specialisation profiles contain more limited data than other profiles. They do not re-list the primary ANZSCO 6-digit occupation’s specialist tasks or technology tools although some or all of them may be applicable. Additionally, these occupations do not include core competencies or capture time spent for specialist tasks. Specialisation profiles should always be considered in the context of the primary ANZSCO 6‑digit occupation to which they relate.

### Not elsewhere classified (NEC) profiles

In March 2022 data for NEC occupations was also added to the Classification. NEC occupation groups are groupings of small occupations that are not captured in another part of ANZSCO which share a similar skill level, and sometimes a similar skill set.

For example the NEC occupation group ‘139999 Specialist Managers NEC’ contains 7 occupations – ‘Airport Manager’, ‘Ambassador’, ‘Ambulance Services Manager’, ‘Archbishop’, ‘Bishop’, ‘Harbour Master’ and ‘Security Manager (Non-ICT)’.

As with the introduction of specialisations, the incorporation of NEC profiles brought with it more range to bring in new specialist tasks and technology tools that provide important context and enrich the Classification.

Skills data for NEC occupations is also not as comprehensive as for other profiles. It includes specialist tasks and technology tools, but not core competencies or the time that is generally spent by the occupation on each specialist task.

### Emerging and Trending Skills

In March 2022 emerging and trending digital skills flags were introduced to the Classification – bringing an exciting new element of dynamism into the Classification which enhanced its responsiveness to a changing and evolving Australian labour market. Previous analysis by the National Skills Commission in 2021, found that digital skills are the fastest emerging skills across the Australian labour market. As at November 2023, we are working towards introducing these flags beyond digital skills in future releases of the Classification.

Trending skills are defined as skills that have grown in demand over the past five years in a particular occupation. They are not necessarily new skills, but skills that are increasing in demand as a proportion of all jobs advertised for that occupation over a five-year period.

Emerging skills are trending skills that are also new to particular occupations. These are distinct from other trending skills in that they have recently emerged in some occupations where they were not previously identified in job advertisements for that occupation until the last five years.

Understanding which skills are trending and emerging in the labour market provides an opportunity to better equip the workforce with skills that align to those emerging requirements.

Although the emerging and trending skills flags add valuable contextual information on labour market dynamics to the Classification, they should be used with caution. The flags utilise aggregated data provided by a third party, and aggregated job advertisement data has its own limitations. The flags should be used as an estimation and complementary to other sources of labour market information.

## Things to note

Profiles only focus on skills: They do not reference licencing and registration requirements, training/education pathways or required knowledge.

Profiles are context agnostic: They apply to occupations regardless of factors such as industry, sector or business size.

The Classification strikes a fine balance between fine-detail and transferability: This means that profiles are not intended to be completely comprehensive lists of every task an occupation undertakes.

The Classification closely aligns with the structure and definition of occupations in the Australian and New Zealand Standard Classification of Occupations (ANZSCO).

## Notes for data users

The Classification changes over time as more information about jobs in the Australian context becomes available to our analysts. Care should be taken not to associate the addition of new skills to the Classification, or changes to the skill makeup of occupations, as reflective of labour market changes or changing skills demand.

For example the addition of the Support diversity and inclusion Skills Cluster and its associated Specialist Tasks in release 1.1 (September 2021) does not indicate a rise in demand for these skills at that time, and care should be taken to account for this change to the Classification in analyses that use Classification data created before and after this date.

Further, for a range of reasons, new versions of the Classification are not backwards-compatible with older versions. For example, the ANZSCO update in November 2021 made changes to a number of ANZSCO occupation codes including where some occupations appear in the overall structure. Further changes may be made to the structure, including codes, as the ABS continues to review ANZSCO.

## Classification releases and updates

The Classification is regularly updated. It is being expanded and improved using an iterative methodology that takes into account a range of data and information.

# Exploring the Classification

## An interactive interface

Users can explore many of the elements of the Classification using the interactive interface on the [Jobs and Skills Australia website](https://www.jobsandskills.gov.au/australian-skills-classification). The interface offers two main ‘lenses’ through which to view the data – through the lens of occupations, or through the lens of skills.

The occupation lens allows users to input an occupation of interest, and explore the specialist tasks, technology tools and core competency scores associated with that occupation. It also allows users to explore the connections between that occupation and others – the top three most similar occupations are also displayed, and selecting any of the specialist tasks will display additional information including the other occupations that utilise that task. These occupation profiles can be downloaded as a printable PDF.

The skills lens allows users to explore how skills are related to one another outside of the lens of occupations. As noted, specialist tasks are grouped into clusters with the basic premise that if you can do one task in the cluster, you can likely do the others (noting that licencing, regulatory and qualification restrictions may apply). These clusters are grouped again into skills cluster families, and users can explore these in more detail using the interface.



**Full dataset**

We strongly encourage data users to download the full Classification dataset, available in XLS format via the interactive interface, in order to access the full range of data points in the Classification, enable easier use of the data for analyses, and power tools and applications.

## Similar occupations – the Classification in practice

The Classification interface is also home to the Similar Occupations interface. This is based on the Skills Transition dataset, which uses Classification data to quantify the degree of similarity between occupations based on their underlying skills. Users can input an occupation and the interface will display up to ten of the most similar occupations. This data is also provided as a CSV or XLS file.

## Guidance

The interface also hosts a range of explanatory information about the Classification to help users to better understand, access and utilise our data. From time to time, Jobs and Skills Australia will also publish insights and analyses that utilise Classification data in order to highlight potential use cases.

If you would like to contact Jobs and Skills Australia directly about the Classification, or have additional questions about the methodology, licensing or usage, you can also email the relevant team at skillsclassification@jobsandskills.gov.au.

# Building, expanding, and improving the Classification

## A data-driven methodology fit for the Australian context

The Classification was first developed by the National Skills Commission (NSC) using a mix of machine learning and human judgement, drawing on different data sources including O\*NET and existing Australian classification systems. Employer surveys, Australian job advertisement data, and education and training course documentation were used for validation and refinement of the Classification.

The initial release of the Classification contained 600 profiles built using the original methodology. Over time, as the Classification has expanded to cover more ANZSCO occupations, this has evolved into a multi-stage methodology incorporating more qualitative consideration of Australian data and information sources.

### Occupation types, titles, descriptions, and codes

The Classification is aligned with the Australian and New Zealand Standard Classification of Occupations (ANZSCO), held by the Australian Bureau of Statistics (ABS). Accordingly, occupation titles, ANZSCO codes, types and descriptions are drawn directly from ANZSCO with the following minor exceptions:

#### Sub-profile codes and occupation types

A sub-profile code has been developed for NEC occupations and Specialisations to differentiate them from the primary occupation associated with that code in ANZSCO. Similarly, the occupation type field of the Classification includes the categories ‘NEC category’, ‘NEC category occupation’ and ‘specialisation’ in addition to the categories ‘ANZSCO 4’ and ‘ANZSCO 6’ which are directly derived from ANZSCO.

**Table one: occupation types and sub-profile codes for NEC occupations under the ICT managers NEC occupation**

|  |  |  |  |
| --- | --- | --- | --- |
| **Occupation type** | **ANZSCO Code** | **Sub-Profile Code** | **ANZSCO Title** |
| NEC category | 135199 |  | ICT Managers nec |
| NEC category occupation | 135199 | N01 | IT Service Delivery Manager |
| NEC category occupation | 135199 | N02 | Network Manager |

**Table two: occupation types and sub-profile codes for specialisations under the Other Spatial Scientist occupation**

|  |  |  |  |
| --- | --- | --- | --- |
| **Occupation type** | **ANZSCO Code** | **Sub-Profile Code** | **ANZSCO Title** |
| ANZSCO 6 | 232214 |  | Other Spatial Scientist |
| Specialisation | 232214 | S01 | Geographic Information Systems Manager |
| Specialisation | 232214 | S02 | Geospatial Analyst |

#### Occupation descriptions

Occupation descriptions are based on ANZSCO descriptions, and where these are not available (for example for NEC category occupations and specialisations), these are developed based on Australian source material including job advertisements and career advice resources, qualification or training information, and regulatory information.

### Core competencies

Core competencies are skills we consider to be common across all occupations. They describe a set of non-specialist skills gained in life and schooling and provide a base to further develop skills and specialties. Other common terms for these types of skills include ‘foundation skills’, ‘core skills’, and ‘employability skills’.

In the initial development of the core competencies, the NSC aligned them to definitions of foundation skills typically used in the Australian vocational education system. Specifically, the Employability Skills framework developed by the Australian Skills Quality Authority (ASQA). The minor differences between the ten core competencies and ASQA’s foundation skills were recommended by education system experts.

#### Score for core competencies

While the ten core competencies are required in every occupation across the labour market, different occupations require different levels of proficiency in each of the core competencies. For example, a clinical psychologist will require a much higher level of proficiency in oral communication than a car detailer, and a car detailer requires a higher level of initiative and innovation than a product grader.

To derive the level of competency required for a core competency within an occupation, the NSC originally mapped the ten core competencies to values from three different O\*NET categories of data that offered the most relevant proxy for each of the ten core competencies – skills, work styles and work activities. The competency levels range from 1 to 10, where the higher the value, the higher the level of proficiency needed to perform a job.

#### Anchor value descriptions

Each numerical competency score also corresponds to a descriptive statement known as an ‘anchor value description’ which gives context to what the numerical level may look like in practice. These statements are general in nature and do not relate specifically to the occupation in question. Three statements were derived from O\*NET with minor changes to map O\*NET’s seven-point scale to a ten-point scale and adapt the language to the Australian context. The remaining seven statements are derived from Australian classifications and ratings systems and modified to fit the context. An example of the anchor value descriptions for the core competency ‘writing’ is shown in table three.

**Table Three: Anchor value descriptions for the competency values for the core competency of writing**

| **Core competency** | **Competency description** | **Value** | **Anchor value description** |
| --- | --- | --- | --- |
| Writing | Communicating effectively in writing in a way that is appropriate for the audience. | 1 | Write name and address on a membership form, copying another document |
| 2 | Write everyday workplace specific vocabulary and abbreviations (e.g., product names) |
| 3 | Take a telephone message |
| 4 | Write a job history as part of a job application |
| 5 | Prepare a standard operating procedures document |
| 6 | Write a memo to staff outlining new directives |
| 7 | Write a detailed literature review |
| 8 | Write a legally binding contract for services provided by one business to another |
| 9 | Write a novel for publication |
| 10 | Write a thesis on metaphor, syntax, and grammar in nineteenth century novels |

#### Our current approach

As the Classification has moved away from the use of O\*NET as a primary data source for the development of new profiles, a new approach has been adopted to determining the proficiency level of core competency required for Australian occupations.

This approach uses similar occupations already in the Classification as a baseline core competency score for the target occupation, which is validated or challenged by research on the skill requirements for the occupation.

Research considers factors such as the occupation’s ANZSCO description, skill level and relevant qualifications, list of specialist tasks, level of responsibility, workspace or environment, and the core competency scores of similar occupations. Similar occupations are decided by considering the ANZSCO family of the occupation as well as occupation similarity data held by Jobs and Skills Australia.

### Specialist tasks

The specialist tasks are designed to describe day-to-day work within an occupation. While these skills can be transferrable across occupations and sectors, unlike core competencies, they are not universal.

To develop the specialist tasks for the first 600 occupations in the Classification’s first release, the NSC utilised O\*NET’s Detailed Work Activities (DWA) as a starting point. To bring the DWAs into the Australian context, tasks that are not commonly performed in Australia were removed or adapted, and tasks were also modified to better fit the Australian context including using language Australians are more likely to use daily.

#### Skills clusters and skills cluster families

The specialist tasks were then clustered into higher level groups called skills clusters with the underlying assumption that if an individual can perform one task in a cluster, they can likely perform others (noting that regulatory, licencing and qualification restrictions may apply). This was done using a mix of machine learning and human intervention. The machine learning element of this methodology utilised three different clustering algorithms, k-means, Affinity Propagation and Spectral Clustering algorithms followed by a customised cluster refining process. A similar process was then used to further group the skills clusters into skills cluster families.

#### Time spent on specialist tasks

To analyse how specialist tasks are utilised within an occupation, the time spent on each task within an occupation is calculated. Originally, the NSC utilised a similar method to that detailed in AlphaBeta’s ‘The Automation Advantage’ (2017) in order to derive the time spent for each specialist task.

The NSC utilised the task ratings survey carried out by O\*NET that asks respondents how often they perform each task in their role, ranging from ‘yearly, or less’, to ‘hourly, or more’. From this, a task utilisation score, or the working hour allocated to a task, was derived for each occupation and task pair. This score was computed by taking the average of implied yearly frequency for a task weighted by respondent share and normalising the values to ensure the time spent across an occupation sums to 100 per cent.

#### Our current approach

As the Classification has continued to grow, less occupations in the Australian context have a sufficiently similar equivalent in O\*NET. Further, we recognise that even where a good match between occupations exists, the specialist tasks in Australia may be different to those undertaken in the American context due to a range of factors including working environment, qualification, and regulatory differences.

As such, since the initial release of the Classification, specialist tasks for new occupation profiles have been developed using a new research-based methodology which favours Australian data and information.

Researchers for the Australian Skills Classification undertake preliminary research to better understand the target occupation in the context of the other occupations within its ANZSCO family group and other related occupations in the Classification (for example, printers and printing assistants are related occupations, but in entirely separate family groups).

In-depth interrogation of Australian sources is then undertaken to better understand the tasks that workers in an occupation undertake from day to day. Sources could include, but are not limited to:

* ANZSCO: which is structured according to skills and provides some information on key tasks undertaken in Australian occupations
* Regulatory and licencing information: which can help rule out tasks in the Australian context (e.g., “prescribe medications” for some health occupations)
* Syllabus for relevant qualifications and training packages: which can provide information on key competencies and skills required to work in an occupation
* Industry, professional or employee representative bodies: which may hold or publish information on critical skills supply and demand issues including emerging skills needs that may not yet be reflected in training or qualifications
* Australian job advertisement data: to provide insight into the key skills employers are requesting in closer to real-time. These often provide key insights into emerging skills needs, and as such form the basis of our emerging and trending skills information
* Stakeholder feedback: stakeholder feedback has been key to a number of improvements to the Classification to date, and we will continue to seek and welcome feedback including proactively through our consultation hub.

Existing data from similar occupations in the Classification is also considered, along with information from other skills frameworks (such as O\*NET) if appropriate.

Depending on the occupation, some sources will be more relevant than others. For example, some occupations are more likely than others to be advertised – farmers and chief executives or managing directors are both occupations with alternative entry pathways, and job advertisement data gives limited insight into these occupations. Medical and health occupations are highly regulated in Australia, so regulatory information can prove very useful in developing or improving these occupation profiles in terms of ruling out tasks in the Australian context – for example ruling out “prescribe medications” for some occupations.

Evidence found during this interrogation is then either matched to existing specialist tasks, or where there is no good match, new tasks may be created. The resulting list of specialist tasks is subject to manual review, as well as validation against relevant related occupations.

Where new tasks are created, they are assigned to skill clusters and cluster families in the existing skill hierarchy.

The time spent on each specialist task is then inferred using a mixed qualitative and quantitative approach:

* qualitative analysis and sources from desktop research are used to estimate the importance and rank of the specialist tasks in occupation profiles
* an algorithmic approach analyses the time spent on similar specialist tasks performed in similar occupations to the target occupation, in order to infer estimates for the time spent on specialist tasks in the target occupation. This approach leverages the skill cluster hierarchy as well as the ANZSCO occupational hierarchy.

### Technology tools

Technology tools are a technology, such as software or hardware, used within an occupation. To derive these for the original 600 occupations, the NSC sourced this data from a combination of ‘software’ and ‘tools’ found in O\*NET for the relevant matching occupation. These were adjusted for the Australian context by cross-reference with Australian job advertisement data from Lightcast (then known as Burning Glass Technologies) and validated using other data sources including results from the NSC’s ‘Survey of Employers Recruitment Experiences’.

#### Aggregating the technology tools

Individual technologies with similar functionalities were originally aggregated together to produce the final technology tools by using the technology family-level of O\*NET. For example, an occupation profile will display the technology tool ‘Accounting software’ rather than ‘MYOB Business Essentials’, although the latter is given as an example of the technology tool. Aggregation makes the results more robust as well as providing transferability between occupations.

#### Common technology tools

Several technology tools are so universal that they are likely to be used by most or all occupations. Rather than being individually listed against each occupation, these are listed under ‘common technology tools’. By doing so, this has the effect of ensuring the remaining technology tools only refer to more specialised technologies that are likely to be meaningfully different between occupations. It also prevents exaggerated transferability between occupations when they share only common technology tools.

Common technology tools are office management software (email and calendar software, word processing software, spreadsheet software, presentation software, desktop publishing software), search engine software, information retrieval and query software, and operating system interfaces.

#### Our current approach

As the methodology for the ongoing development and improvement of the Classification has evolved, it involves a greater consideration of relevant related occupations, and Australian data sources in line with those laid out the specialist tasks.

As the technologies used in Australian occupations have changed and more occupations have been brought into the Classification, the technology tools, their structure and examples in the Classification have also adapted over time.Some technology tools names, definitions and examples have been revised and edited from a usability perspective.

We are continuing to review and update our technology tools, their structure and examples with each release.

### Emerging and trending skills

Emerging and trending digital skills flags were introduced into the Classification as a further move to ensure it is dynamic and responsive to the Australian labour market.

As noted above, trending skills are skills that have increased in demand for a particular occupation over the past five years based on job advertisement data. Emerging skills are trending skills that are new to particular occupations over the past five years.

Understanding which skills are trending and emerging in the labour market provides an opportunity to better equip the workforce with skills that align to those emerging skills needs, and us such these flags are regularly updated to reflect up-to-date job advertisement data.

#### Our current approach

To identify emerging and trending skills from job advertisement data, a five-year reference period is first calculated to identify skills that have grown across occupations during that time. Where possible, job advertisements are considered for occupations at the ANZSCO 4- or 6-digit level, however where occupations at this level do not meet the threshold for number of job advertisements listed in the latest year, we consider jobs at the next level up the ANZSCO hierarchy.

We then measure the proportion of jobs advertised that request a skill, discounting occupations that do not meet a threshold level of job advertisements in the reference period. Trending skills are defined as those skills that have grown in their proportion of jobs advertised between the start year and end year, and emerging skills are those that did not appear in the reference period start year but are present in the next four years.

To help us match these skills to skills in the Classification, Jobs and Skills Australia holds a skills concordance that has mapped skill names from job advertisements to one of nine skill types:

1. abilities
2. experience domains
3. job role
4. knowledge domains
5. licensing or registration
6. specialist tasks
7. technology tools
8. work conditions
9. undefined.

Only two skill types, the specialist tasks and technology tools, are further mapped to the Classification.

Using this concordance each job advertisement skill name flagged as trending or emerging for occupations where it was identified, were mapped to a corresponding specialist task or technology tool defined in the Classification. Skill names that were mapped to skill types other than a specialist task or technology tool were excluded from the analysis.

Further analysis and validation is then undertaken to determine the quality of the emerging and trending skills matches to the occupation. This involves qualitative desktop research and human judgement.

In order to determine time spent on emerging or trending specialist tasks that are inserted into an occupation profile, a formula is used to algorithmically predict a profile rank for each specialist task. This formula is an estimate and is not a complete replacement of qualitative validation but rather a guidance to reduce the cognitive analysis time a researcher spends on evaluating the rank of a specialist task insertion.

In principle the rank of a specialist task within a profile is estimated from the average of all similar skills (all specialist tasks within a skill cluster family) in all similar occupations defined in the Classification (occupations belonging to the same ANZSCO-3-digit minor group).

### Skills Transitions dataset

The Skills Transition dataset uses the Classification to quantify the degree of similarity between occupations based on their underlying skills. One of the challenges of skill-based analysis is that skills are often best understood in terms of the text that describes them rather than aligning with specific standards and frameworks.

This methodology overcomes this lack of standardisation by making use of a machine learning technique called natural language processing to consider not only shared tasks between occupations, but also the intuitive meaning and phrasing of words in order to understand how skills relate to each other.

#### Natural language processing

Machine learning can handle large quantities of data in a way which could not be done with other techniques. Natural language processing takes this one step further to allow the analysis and comparison of large volumes of text-based data. Doing this manually is time consuming and difficult to replicate in a consistent way.

Unlike naturally numeric data, text cannot be directly used by machine learning models. First it must be transformed by models into numerical representations with the meaning of the text embedded. Language models achieve this by representing text as vectors. These are series of numbers, which reflect different aspects of the original text’s semantic meaning.

Pre-trained transformer models provide high performance to ordinary users by taking advantage of the asymmetry in resources required for model training and model inference use in applications. Model training requires dedicated large-scale infrastructure and enormous datasets. However, once trained, these models can be downloaded and applied on a typical high-end laptop.

In this analysis, the Commission uses Google’s Bidirectional Encoder Representations from Transformers (BERT) model which is available for public use. BERT broke several NLP benchmarks upon its release in 2018 and is maintained by Google.

**Data and model**

The Skills Transition data relies on language models that represent text associated with occupations as vectors. Aggregating these vectors across the different text components of occupations then allows the calculation of similarity scores between occupations.

The analysis includes 857 Australian Skills Classification profiles, of which 628 are ANZSCO 6-digit occupations and 229 are ANZSCO 4-digit unit groups. The model uses information from both the Classification and the Australian and New Zealand Standard Classification of Occupations (ANZSCO) including:

* Specialist Tasks
* Skills Clusters
* Skills Cluster Families
* Core Competencies
* Technology Tools
* ANZSCO descriptions
* ANZSCO titles
* ANZSCO codes.

The text-based components are vectorised separately using BERT. Where there are multiple instances of inputs for an occupation, a weighted average is calculated using their frequency or magnitude as weights. These components are then amalgamated using weighting into a combined BERT vector for each occupation which allows for cosine similarity to be computed.

The numeric components such as Core Competencies and ANZSCO codes are treated separately as differences can be calculated directly.

The overall similarity score considers both the text-based and numeric components. Similarity scores are calculated for any given occupation against all other occupations. For a given occupation, the similarity to all other occupation is ranked and the similarity score is converted into bands of ‘high’, ‘medium’ and ‘low’ for ease of use.

### Validation exercises

As part of the initial development of the Classification, staff from the NSC (and the Department prior to the creation of the NSC) undertook various validation exercises to ensure the accuracy of the Classification prior to a public release.

This included an independent market testing exercise (conducted by Nous Group), core competency improvements to improve linkages between the competencies and existing skills frameworks, and a technical validation exercise (undertaken by Quantium) to validate the overall technical approach and determine if the Classification was reflective of the Australian labour market.

For the Skills Transitions dataset the Commission engaged an external consultant, Kuaba, to conduct a strategic assessment of this analysis. The Kuaba team, which included machine learning expert Professor Lexing Xie, found the approach used to be suitable, and the application and analysis of the input data to be logical and sound with rational, validated outputs.

Jobs and Skills Australia continues to engage with subject matter experts on the ongoing expansion and improvement of the Australian Skills Classification, including through our established feedback channels.

# Feedback and ongoing improvement

The Classification is a dynamic dataset which is regularly updated to ensure data remains responsive to occupation and skills changes, and relevant to the Australian context.

The initial release of the Classification was based on a data driven methodology, and we have worked hard to refine our data and better align it with skills needs in an Australian context.

Stakeholder feedback has been a vital source of information to support the improvement process, and we welcome feedback from anyone with an idea or suggestion on how we can improve our data.

From time to time, we may also release information ahead of publication on the [Jobs and Skills Australia consultation hub](https://www.jobsandskills.gov.au/consultations).

For more information on how Jobs and Skills Australia will manage and respond to feedback please [visit our website](https://www.jobsandskills.gov.au/australian-skills-classification#faq).

You can also click here to email our team.