

# Meeting Employers' and Students' Expectations through the use of Employment Demand Ontology in curriculum development

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**Abstract-** It has become evident in recent times that curriculums do not sufficiently cover the expected employment skill needs of graduates to be job ready directly post obtaining their qualifications. In order to assure an appropriately trained and job ready graduate workforce, it is imperative that employer expectations are incorporated into curriculums offered to students who are hoping to be trained for professional advancement. Current data gathering methods of employer expectations are time, cost and labour intensive resulting in mismatched skill sets for graduates. This paper introduces employer demand ontology currently being developed which will enable employer demand expectations to be accurately and continuously identified and incorporated into specific curricula through the use of artificial intelligence.

## INTRODUCTION

It's well known that adults undertake learning for one of the following reasons [1]: Social relationships, external expectations, social welfare, professional advancement, escape/ simulation or cognitive interests. Amongst these reasons, professional advancement has the biggest influence on adults' motivation for further studies. To ensure these students' needs are met it is imperative that curriculum design includes learning material based on current and true employment skill set needs. Graduates displaying skill sets that are relevant and usable in the workplace will be able to advance much quicker in their career path.

There is a huge drive of late to incorporate employer expectations for graduate skill sets into curriculum design. Changing technology, globalisation of the world economy and the drive towards sustainable practice have highlighted the need to revisit curriculum content continuously to ensure 'work ready' graduates. Claims that universities should prepare their students with a more comprehensive range of skills due to graduates being ill equipped to enter the workforce and miss matches between where people were trained and where they were needed in the workforce occupy the media frequently [2-7].

There are a range of issues associated with current methods that determine employer demand for occupation types [8] where the most common method used is survey based enquiry (examples include [4, 9-11]). Survey outcomes are inconsistent due to arbitrary and idiosyncratic classifications of information by the survey administrator, employer and analyst. The consistency of survey administration methods and mutual understanding of the concepts involved in the survey has a great impact on the validity of the effort. Unfortunately due to human nature it is very difficult to apply these methods consistently from one survey to another and from one survey administrator to another survey administrator. It is imperative that a standardised, consistent method is developed where opinion and human factors are excluded and artificial intelligence provides for such an opportunity.

## EMPLOYER DEMAND ONTOLOGY

Perfect labour market equilibrium exists when 1. Employers are able to employ workers that they need (comply to the standards that the employer expects the worker to have to complete the job), and 2. When employees hold the skills that are needed to be employable. To achieve this equilibrium, it is imperative to identify the needs of employers in order to train employees accordingly.

Current studies that attempt to identify employer requirements suffer from many weaknesses such as significant time, cost and labour constraints, resulting in unreliable and too aggregated data sets. In recent years Information and Communication Technologies (ICT) have been extensively developed to provide artificial intelligence. Computers can now gather, analyse and report on vast amounts of data which humans cannot do and offer methods to overcome the weaknesses of current data collection methods found in employer demand studies.

A very effective way to learn about current employer demand is to analyse job advertisements [12]. Job advertisements contain very rich data on the aspects which employers demand from future employees [13] in order to perform a specific job. To understand what these requirements are, a study of employer demand is necessary

however this task is manually intensive if it is to be performed to an optimum standard.

Information and communication technologies have developed rapidly over the last few years and the usage of online job advertising has soared to record numbers. Most employers are utilising the web to advertise their vacancies and this information is publicly free and available to anyone with access to the internet. Sifting through this information manually is the challenge though but ICT systems have the ability to do this without time delay through what is called Artificial Intelligence.

Artificial intelligence requires baseline knowledge of the concept in order to process information into categories understandable to researchers. This knowledge can be compiled into semantic maps (ontology) of the domain that the researcher wishes to study. This paper serves to introduce the developmental work that the author is currently doing where the author has started developing employer demand ontology. The purpose of employer demand ontology is to enable artificial intelligence processing of employer demand data obtained from job advertisements. Some of the initial concepts included in the ontological map under development are described below.

#### METHOD

As a trial or initial phase for the ontology building exercise the author has decided to build ontology for the nursing profession in Western Australia. The nursing profession has been severely influenced by a shortage of skilled personnel and the importance of gathering quality skills related data for this profession is justifiable.

For the trial, five week's worth of registered nurse online advertisements from Seek.com.au will be analysed to gather information relating to nursing: firstly by building the ontology, and secondly by capturing how many times specific ontological classes and instances occurred in these records. This should give a clear indication of how strong certain skills are required in geographically specific areas, which skills are similar across all areas and which skills should be incorporated into the nursing curriculum to ensure graduates are job ready.

Seek.com.au [14] is Australia's premier job advertising website and has been identified as the trial job board for this research. Seek offers four criteria to search against when future employees look for current vacancies (Figure 1): Keywords, Classification, Location and Salary.

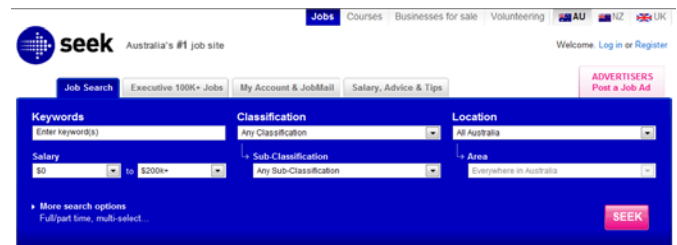


Fig. 1. Seek's search criteria [14]

The Classification drop down box has an option of 'Healthcare & Medical', which offers a range of Sub-Classifications related to this major occupational group. Of concern to nursing professions, the following 11 occupations are available to search against:

1. Nursing- A&E, Critical Care & ICU
2. Nursing- Aged Care
3. Nursing- Community, Maternal & Child Health
4. Nursing- Educators & Facilitators
5. Nursing General Medical & Surgical
6. Nursing High Acuity
7. Nursing- Management
8. Nursing- Midwifery, Neo-Natal, SCN & NICU
9. Nursing- Paediatric & PICU
10. Nursing Psych, Forensic & Correctional Health
11. Nursing- Theatre & Recovery

To ensure we capture all the required nursing vacancies that were advertised between the dates of 17 Dec 2010 until 24 January 2011, 22 job alerts were set up to email job vacancies to us. The job alert criteria comprised of the following: Healthcare & Medical as main occupational classification, with each type of the eleven nursing sub classification to search for in both Perth and Regional WA. The remaining search criteria were left to the default values. This includes the salary range to be from \$0 to \$200 000+ values and the work types to be set to All Work Types which ensured all vacancies were captured that were being advertised for the target dates (Table 1).

TABLE I  
JOB ALERT MATRIX

		Location	
		Perth	Regional WA
Occupational Classification	Healthcare & Medical		
	Nursing- A&E, Critical Care & ICU	•	•
	Nursing- Aged Care	•	•
	Nursing- Community, Maternal & Child Health	•	•
	Nursing- Educators & Facilitators	•	•
	Nursing- General Medical & Surgical	•	•
	Nursing- Management	•	•
	Nursing- Midwifery, Neo-Natal, SCN & NICU	•	•
	Nursing- Paediatric & PICU	•	•
	Nursing- Psych, Forensic & Correctional Health	•	•
	Nursing- Theatre & Recovery	•	•
Nursing- High Acuity	•	•	

The Australian Bureau of Statistics (ABS) recently developed a new, comprehensive occupational classification system called the Australia and New Zealand Standard Classification for Occupations (ANZSCO). The system is divided into Major Groups, Sub-Major Groups, Minor Groups, Unit Groups and Occupations. Each classification level and instance is additionally labelled with a numerical code and the major groups are depicted in Figure 2 below.

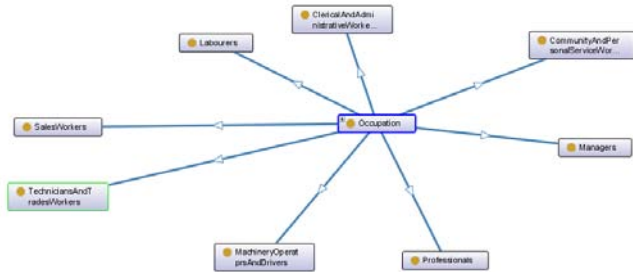


Fig. 2. Major ANZSCO occupational groups

A further two levels down from the ANZSCO ‘major’ occupational groups lists the 12 nursing occupation specialisations (Figure 3). To ease data collection and ontology development for the vacancies found on Seek’s drop down searching facility, it was necessary to map Seek and ANZSCO’s classifications (Table 1) as Seek’s search categorisation only included 11 nursing categories (Table 2) and they were quite different from the ANZSCO categories.

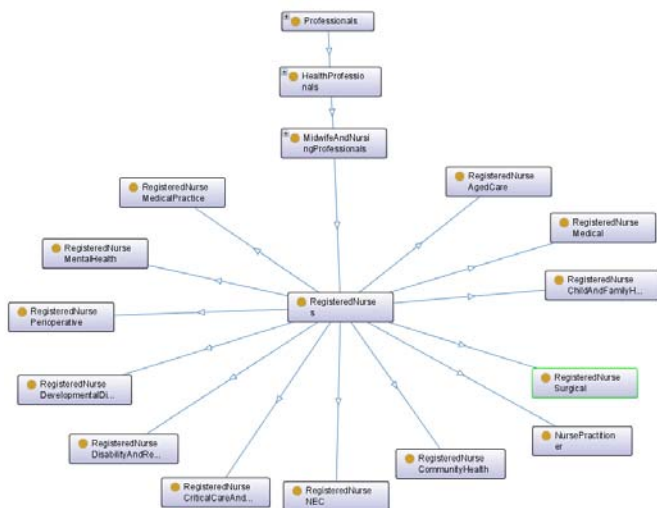


Fig. 3. ANZSCO Registered Nurse Occupations

TABLE 2  
MAPPING OF SEEK AND ANZSCO NURSING OCCUPATIONS

Seek	ANZSCO
Nursing- A&E, Critical Care & ICU	Registered Nurse (Critical Care and Emergency)
Nursing- Aged Care	Registered Nurse (Aged Care)
Nursing- Community, Maternal & Child Health	Registered Nurse (Community Health)
Nursing- Educators & Facilitators	Registered Nurses NEC (not elsewhere classified)
Nursing General Medical & Surgical	Registered Nurse (Medical), Registered Nurse (Medical Practice), Nurse Practitioner
Nursing- Management	Registered Nurses NEC (not elsewhere classified)
Nursing- Midwifery, Neo-Natal, SCN & NICU	Registered Nurse (Child and Family Health)
Nursing- Paediatric & PICU	Registered Nurse (Child and Family Health)
Nursing- Psych, Forensic & Correctional Health	Registered Nurse (Developmental Disability), Registered Nurse (Mental Health)
Nursing- Theatre & Recovery	Registered Nurse (Surgical), Registered Nurse (Perioperative), Registered Nurse (Disability and Rehabilitation)
Nursing High Acuity	Registered Nurse (Critical Care and Emergency)

Seek’s location search criteria drop down box for Australian locations provides the options to search against major cities and regional areas (listed in state and territory groupings). When Perth is chosen as the Location, the Area drop down box offers the following search options:

- All Perth
- CBD, Inner & Western Suburbs
- Eastern Suburbs
- Fremantle & Southern Suburbs
- Northern Suburbs & Joondalup
- Rockingham & Kwinana

Similarly, when regional WA is chosen in the main Location drop down box, the following regional areas becomes available to search against:

- All Regional WA
- Albany & Great Southern
- Broome & Kimberley
- Bunbury & South West
- Geraldton, Gascoyne & Midwest
- Kalgoorlie, Goldfields & Esperance
- Mandurah & Peel
- Northam & Wheatbelt
- Port Hedland, Karratha & Pilbara

Both Perth and Western Australia will be searched against for all nursing occupation vacancies as this paper focuses on the whole of Western Australia.

The ABS has compiled a comprehensive list of all Australian locations called the Australian Standard Geographical Classification [15]. The ASGC lists locations by State and Territory, Statistical Divisions and Statistical Subdivision and Statistical Local Areas.

The employer demand ontology utilises the ASGC to enable geographical comparisons and to assist the collection and analyses of data from different kind of studies for each geographical division in Australia.

For each vacancy found in the listed regions, the employer **requirements** will be analysed and categorised against the various occupation classifications per region as follows: additional requirements, attribute requirements and skill requirements, where skill requirements will again be subcategorised into competencies, experience, knowledge, licence or registration and qualification- the information that will be crucial in curricula development. Additional

information that will be collected include wages offered, employer, employment conditions, period of advertisement and employee benefits.

## CONCLUSION

Students and employers both expect graduates to be appropriately skilled so they can enter the workforce with the expected skill sets and be job ready. To ensure employers and students' expectations are met, it is imperative that curriculum design includes true and accurate employer skill expectations which students can learn, practice and be assessed against before graduating. Survey methods currently in use to obtain this type of information suffer from various complications and artificial intelligence offers a way to bypass these issues. In order for artificial intelligence to be used, a semantic ontological framework first needs development. This paper has introduced the first steps towards an integrated ontological map currently under development that will form the framework which will enable automated employer demand identification.

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