

# **Bridging the gap between Australian pathology and university education: Student perceptions of a career pathway in medical laboratory science**

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Work-integrated learning (WIL) for students studying medical laboratory science (MLS) provides hands-on experience that prepares graduates for entry into the pathology workforce. This study explored the student perceptions of studying MLS, before and after WIL placement in a pathology service, and the associated employment opportunities in a pathology laboratory. The WIL pathology technician model enabled students to gain experience across regional and metropolitan locations within the state of Queensland, Australia. With nearly two thirds of graduates employed in the profession and a quarter continuing further education in this field, this program was regarded as a success and helps meet the needs of a growing population with an expectancy of high quality health care. Discussed in this paper is the unique role of the pathology industry working with a regional university to develop successful graduates for a career in pathology, with a focus on the impact of WIL.

**Keywords:** Work-integrated learning, employability, medical laboratory technician, pathology, tertiary education

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The overarching requirement of a medical pathology service is to provide competent medical testing within a quality system that determines the cause and nature of diseases (Royal College of Pathologists of Australasia, 2017). Examination and testing of body tissues and fluids informs the correct diagnosis and appropriate treatment of the patient. In Australia this service is provided by medical, scientific, technical and support staff in public and private pathology organizations. Whilst the medical and support staff role descriptions are clearly articulated, there is no precise definition of the duties and responsibilities of the medical laboratory technician and scientist (Badrick & St John, 2012). Both groups are responsible for test results to enable accurate patient diagnosis and effective treatment, work in the same settings (e.g., 24-hour shift roster) and have similar responsibilities. However, most pathology scientists have higher university qualifications, receive greater remuneration, and exercise a supervisory relationship with regard to the technical staff.

The primary qualification for a medical laboratory scientist in Australia is a three to four-year university degree that encompasses diagnostic pathology training. Historically, medical laboratory technicians were trained through two year diplomas (or equivalent, e.g., level 4 certificate) offered primarily through the vocational Technical and Further Education (TAFE) system because universities were not addressing the industry skills required (Kosky, 2002). In Queensland many of these diploma qualifications were phased out in the late 2000s due to low student completion rates and government funding cuts (Gale et al., 2013). This resulted in a decline in experienced technicians and an increase in graduates with inadequate pathology skills and knowledge due to minimal laboratory experience.

A previous study by Andre and Barnes (2010) highlighted the importance of industry involvement in program design as imperative to the success of the program. To achieve the desired educated 'workforce ready' medical laboratory technician, the Queensland pathology industry approached

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Queensland educational providers in 2010 with a proposal to introduce a two year Associate Degree in Medical Laboratory Science (AssocDegMedLabSc) program. One of the tertiary institutes involved in this initiative was the University of the Sunshine Coast (USC), a regional university located 100km north of the Queensland capital Brisbane. In 2012, a new AssocDegMedLabSc program commenced at USC and was tasked with the provision of specialized education, laboratory experience and graduating 'workforce ready' medical laboratory technicians. The students graduating from the program would be qualified for employment as a medical laboratory technician in public or private pathology services throughout Australia. Furthermore, because of the extensive laboratory competencies taught, students would be qualified for employment as laboratory technicians in other scientific and education technical services.

To ensure graduates received the appropriate, high quality laboratory experience, regional academic and pathology stakeholders discussed the importance of hands-on skills and the need for clinical experience associated with appropriate work placement. A pathology specific curriculum was developed incorporating the disciplines of chemistry, histology, hematology, microbiology and blood banking which were underpinned by a foundation course in medical laboratory science. A compulsory component of the program was a 50-day work-integrated learning (WIL) placement in pathology laboratories located in rural, regional or metropolitan areas throughout Queensland. As the WIL programs rely on laboratory supervisors, with little or no teaching experience to facilitate training (Miller, 2014) a competency manual was developed by industry in conjunction with the university assessment requirements for students to complete during their WIL placement. The competency manual provided autonomous evidence of skills and knowledge learned in the pathology laboratory which were verified by a pathology supervisor.

In Australia, WIL continues to grow (Dickson & Kaider, 2012) and provides an opportunity for universities to attract students to vocational programs offering real-world experiences in institutes with a potential investment in that job market (Reddan, 2017). This is advantageous for both the university which invests the time, resources and staff to develop a WIL program and the industry stakeholders who benefit from being directly involved in developing the skills of the students relevant to the needs of their industry (Lowden, Hall, Elliot, & Lewin, 2011). Workplace learning facilitates structured experiential learning (Cooper, Orrell, & Bowden, 2010), exposes the student to potential employers (Braunstein, Takei, Wang, & Loken, 2011), provides workplace expectations before graduation (Murphy & Calway, 2008), and may influence their decision whether or not to pursue a career in the profession (Zegwaard & McCurdy, 2014). While WIL placement has been important for training undergraduate students in healthcare, there has been very little research, particularly in pathology, into the actual experiences of students while on placement, and how the placement experience influences students' employment and career opportunities. Clinical placement is vital in learning laboratory skills (Miller, 2014) but may also have other influencing factors. Particularly, the student's perceptions on the individuals who provide instruction while on WIL placement and whether their motivation and enthusiasm for the industry influences student retention and employment/education success in pathology.

Therefore, the aim of this paper was to explore student perceptions of the pathology profession in a longitudinal study: pre- and post-work-integrated learning followed by actual student graduate outcomes.

## METHOD

### *Participants*

Participants in the study were first year students in the AssocDegMedLabSc at USC from 2014-2016. All were enrolled in a WIL placement for 20 days (145 hours) in their first year and 30 days (218 hours) in their second year at either a private or public medical pathology laboratory in a regional or metropolitan facility in Queensland, Australia.

Purposive sampling was used for recruitment because it was a defined group of students who: a) had not yet completed a WIL placement; b) fulfilled the pre-requisite admission process; and c) had no previous experience in a rural, regional or metropolitan pathology laboratory. Over a three-year period, there were five sessions of WIL for first year students to attend. All of the enrolled students who did not withdraw, transfer or have an incomplete program were invited to participate in the study (N=31). An academic staff member, not associated with the research, recruited students to participate. The researchers were blind to which students agreed to participate in the study and were not involved in recruitment, consent or participation.

### *Pre- and Post-Work-Integrated Learning Survey*

Prior to their WIL placement students were required to complete the pre-requisite subjects to learn the essential concepts of pathology. The subjects were: chemistry, cell biology, foundations in medical science, communication and thought, human physiology, hematology and histology. It was necessary for the students to complete the mandatory requirements for working in a pathology laboratory (i.e., hepatitis B immunization, confidentiality form, and placement agreement). Before commencing their placement, all students were required to attend a pre-placement orientation session and were invited to attend a tour of a local public pathology provider. The students were also informed about the study for participant consent.

Prior to confirmation of their first pathology placement location, students completed a pre-WIL survey. The questionnaire used to conduct the survey was developed using a sociocultural framework (Eames & Cates, 2011) and was used to understand student learning and experience of WIL. A mixed method approach of Likert and short answer questions throughout the longitudinal study was used. Analyses were conducted pre and post placement to identify demographic data (gender, age group, residential postcode, placement postcode) and the perception of educational and graduate outcomes achieved by medical laboratory science students enrolled in a pathology placement.

The surveys investigated: a) the motivations of undergraduate students seeking work in the pathology profession after graduation; b) if choice of subject/pathology discipline would be influenced by WIL; c) the role description and career opportunities in the current employment climate; and d) whether WIL would influence change in student perceptions of the pathology profession. Students were asked to respond using a four-point Likert scale to self-perception questions, for example: "Before I start placement I have a good understanding of the career opportunities when I graduate" and "I currently feel positive about job security and employment in the pathology industry" with the following choice of response: 1= 'Strongly Disagree'; 2= 'Disagree'; 3= 'Agree'; and 4= 'Strongly Agree'. The pre- and post- questionnaires are available from the corresponding author on request.

### *Graduate Registry*

At the completion of the study, a graduate registry was compiled from students, academics and pathology staff to ascertain graduate retention in the field, region of employment, and further education in the MLS discipline. Student progression in the pathology profession was recorded after WIL, up to three years through the graduate registry.

### *Statistical Analysis*

Quantitative data and frequency analytics were analyzed using the Statistical Package for Social Sciences (SPSS) version 22 (SPSS Inc., Chicago, IL). Data were analyzed using paired sample t-tests with criteria of 95% confidence interval. Qualitative respondent answers were analyzed to identify a theme or keyword that was then used in a coding scheme to identify positive, negative or indifferent comments (Graneheim & Lundman, 2004).

### *Human Ethics*

The study received human ethics approval from the University of the Sunshine Coast's Human Research Ethics Committee (A14632).

## RESULTS

### *Demographic and Descriptive Results*

Of the 31 students invited to participate, 94% (N=29) consented to be involved and these were composed of 26 females (90%) and 3 males (10%). These gender statistics (predominantly female) are representative of the pathology technician workforce statistics. Of these 29 students, 41% were less than 23-years old and 41% were greater than 27-years old. While all the students were enrolled in the AssocDegMedLabSc program, 46% had completed or were concurrently enrolled in a different degree and 10% stated that they would enroll in further study (biomedical degree) after graduating. All students completed the pre-placement orientation session and approximately half (55%) attended the voluntary laboratory tour of a public pathology laboratory. Students who attended the laboratory tour, responded that the most useful element was "seeing a laboratory first hand" (38%), "meeting the industry staff" (25%), and the "presentation from a senior representative from Queensland Health" (19%). For those students who did not attend the tour, most said the date or time was inconvenient.

Using the Australian Statistical Geography Standard (ASGS) Remoteness Structure from the Australian Bureau of Statistics (2016), the residential post code provided by each student was mapped using the residential classification: RA1 – Major City (24%); RA2 – Inner regional (28%); RA3 – Outer Regional (35%); RA4 – Remote (10%); RA5 – Very Remote (0%). The geographical distribution of residential addresses spanned approximately 350 km for students studying at the regionally located university. Students were assigned to 14 different public or private pathology providers across Queensland ranging from far North Queensland (Cairns 16.92° S) to South East Queensland (Southport, Gold Coast 27.97° S). The pathology providers were predominantly located in RA2 - Inner regional (76%) locations, followed by RA1 - Major city (21%) and RA – 3 Outer Regional (3%). The sites covered approximately 1,800 km of the state. Using the same remoteness classification, the student residential addresses and pathology provider addresses for their WIL placement were mapped (Figure 1).

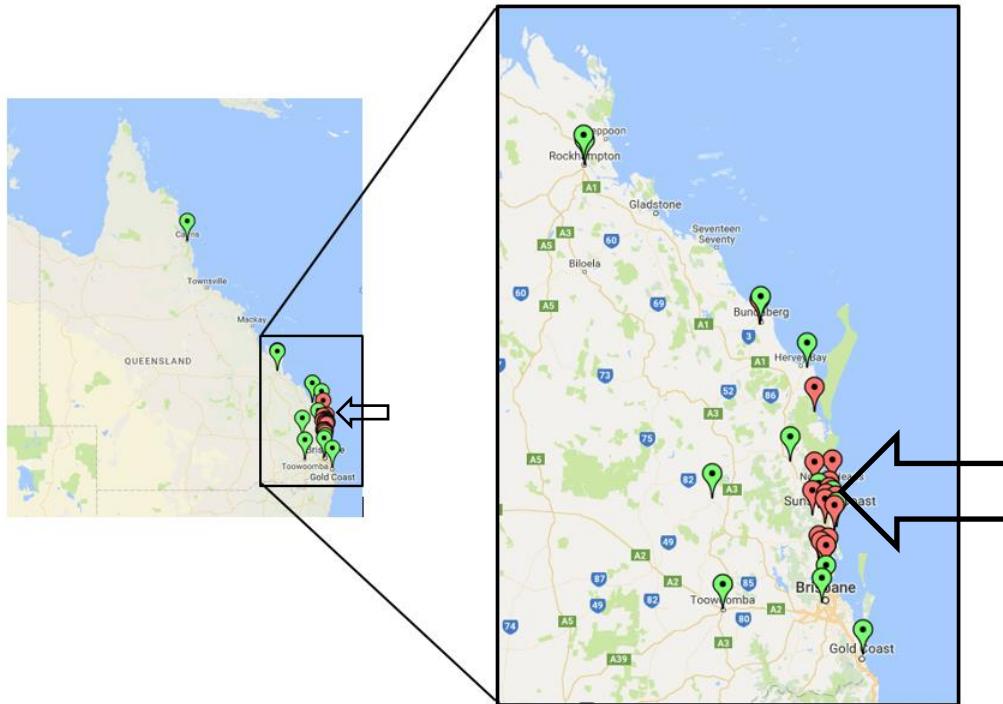


FIGURE 1: Residential address (red) of students participating in this study, compared to his or her WIL pathology placement site (green) in Queensland, Australia. Arrow indicates the location of the regional university, USC where the Associate Degree in Medical Laboratory Science was offered.

#### *Pre-WIL Survey Results*

Students agreed or strongly agreed they were adequately prepared (96.6%) and had received adequate instruction (100%) from their pre-requisite first year subjects to commence the WIL placement. The subjects they considered had best prepared them were linked directly to pathology placement and included hematology (51.7%) because “blood was the most requested test in the laboratory” followed by foundations in medical science (37.9%) because “there was useful information for working in a laboratory that included quality control etc. and provided a good overview of lab protocols” and histology (6.9%) because “it covered the human body and related structure to function”. Students responded that the subject, ‘communication and thought’, least prepared them for their WIL subject (82.8%) followed by chemistry (10.3%). Two students commented that the communication subject “was not useful for a scientific field, my subjects are practical not written” and “it doesn’t provide information in regard to placement preparation, I don’t think debating skills and argumentative essays would be useful in a laboratory”. Another student commented that the chemistry subject “was not relevant to working in the lab”.

Before starting a WIL subject in 2014, students agreed or strongly agreed that they understood the role of the pathology technician (93.1%) and the career opportunities as a graduate (89.6%). When asked specific questions regarding role and career opportunities, almost a half (48.3%) of the students were unsure what the current unemployment rates for medical laboratory technicians were and a third (34.5%) believed it was the same as the average workforce. Considering the future, over the three years

(2014-2016), approximately half of the students (48.3%) believed employment for medical laboratory technicians was expected to grow; however, a quarter (24.1%) were unsure about the trends in the profession, and 10% believed it would decline. In relation to current earnings in 2014/2015, two thirds (62.1%) of the students believed the earnings for a medical laboratory technician was the same as the annual Australian average, 6.9% thought that they were above average, while a quarter (24.1%) were unsure.

The majority of students (72.4%) felt positive about job security and employment in the pathology industry. Permanent work and job security (69%) were more important than wage earnings (24.1%), and further tertiary education (13.7%). However, 44.8% of students believed they would continue further tertiary education either while they were working as a graduate (3.4%), after completing a year or more in the pathology profession (27.6%), or immediately after graduating from the associate degree (13.8%). A small number of students considered that they would not work in the pathology profession but would (3.4%) or would not (3.4%) seek work as a technician in a profession other than pathology. Figure 2 presents the students perceptions of the value of: adequate preparation; career opportunities; and current perceptions and goals, before commencing WIL.

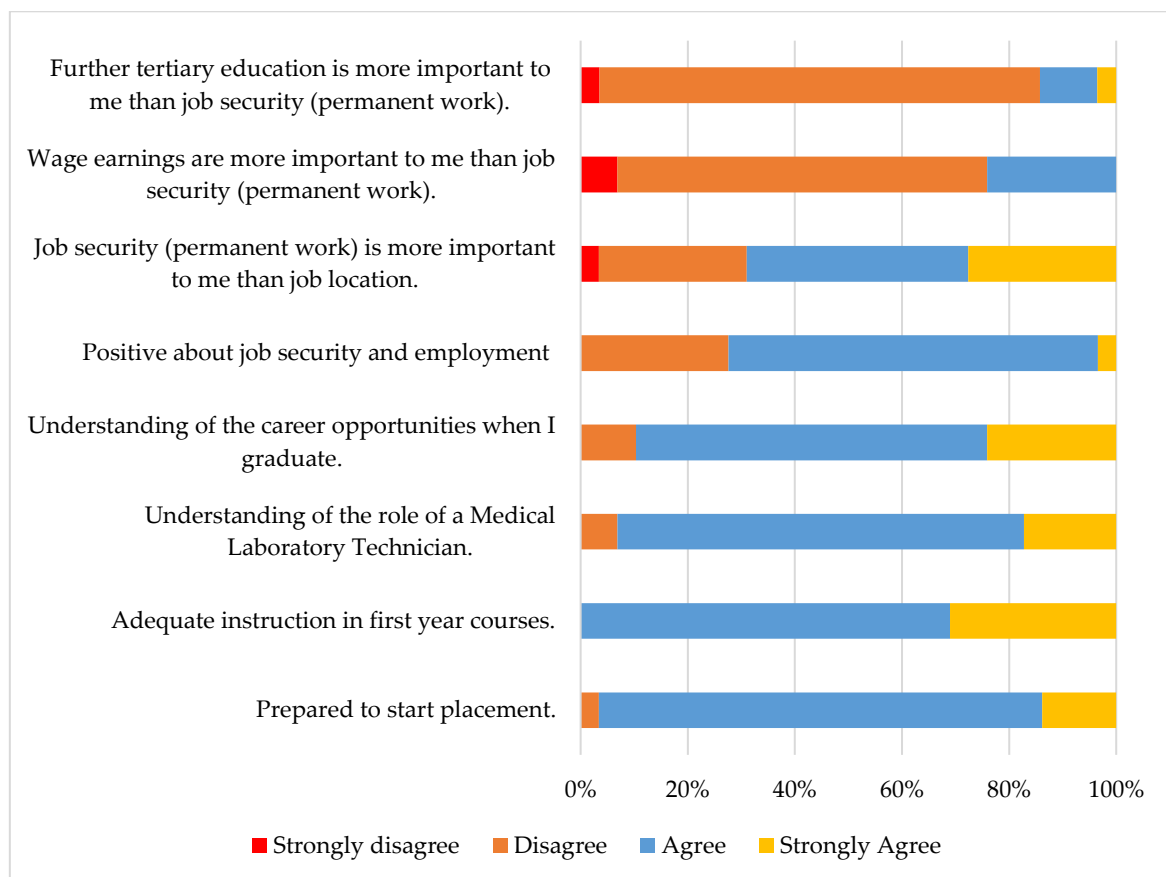


FIGURE 2: Student response ratings using a 4-point Likert scale on the statements on: current perceptions and goals; role and career opportunities; and adequate preparation before commencing work-integrated learning.

Prior to WIL and not knowing where their WIL location was, students were asked to rank their most preferred future job location and their preference for either the public or private pathology sector.

While the majority of students (75.9%) showed no preference for a job in a public or private sector, most of those (20.7% of 24.1%) that did have a preference selected the public sector. Almost half (44.8%) of the students had no preference for job location, while those that did have a preference regarded a regional location (34.5%) more appealing than a metropolitan location (20.7%). None of the students selected a rural location as their first preference for job location.

There were mixed feelings amongst the students about commencing WIL. Two students commented positively with, "I'm looking forward to it" and "feeling excited". However, two students were apprehensive about commencing WIL with "I'm extremely anxious and unprepared, I'm terrified to make mistakes" and "a little bit unsure of what to expect and worried I don't have adequate knowledge to be on placement".

#### *Post-WIL Survey Results*

Of the 29 students who completed the study, 18 completed the post-WIL survey (response rate, 62%). All students responded that the pathology staff provided a good description of the role of the medical laboratory technician and all were motivated to graduate and seek employment in the pathology profession. Most students had a preference to seek employment in a multidisciplinary laboratory (50%), followed by blood banking (22%) and then other specialized disciplines. The least preferred disciplines were specimen reception (41%), histology (29%) and chemistry (18%). The student perception about earnings for medical laboratory technicians changed significantly after WIL (Pre-WIL:  $2.6 \pm 0.98$ ; Post WIL:  $3.05 \pm 0.94$ ,  $t(18) = -3.00$ ,  $P = 0.008$ ). Pre-WIL 62% of students believed that earnings were the same as the national average earnings, whereas post-WIL 44% of students were unsure if a medical laboratory technician's earnings were below, the same, or above the national average earnings.

As presented in Figure 3, there were no significant differences of the students perceptions before and after WIL for: 1) feeling adequately prepared before placement; 2) preference for job sector (public/private) or job location (rural/regional/metropolitan); 3) job security, growth and unemployment; and 4) goals after graduation (education and/or permanent work). Open-ended responses to the WIL experience from the students were all positive. One student commented, "I absolutely loved the work placement as it allowed me to get a comprehensive view of the workflow of a laboratory. This allowed me to not only participate but to gain an understanding of the steps involved in various tests. Seeing all of the laboratory machinery and techniques functioning daily has consolidated a lot of the information that I have been taught at university". Another two students commented that "the insight I felt I gained from the experience was invaluable" and "having a clinical placement in the first year is very useful as it enables you to consider whether you really want to work in pathology – a very valuable experience".

#### *Graduate Registry*

Twenty two of the 29 students (76%) in the study graduated from the AssocDegMedLabSc program at USC. Four students (14%) were still enrolled in the program as part-time students and were yet to graduate. Three students (10%) who commenced the program withdrew after WIL and, of those who graduated, two students (7%) were continuing their studies in a new biomedical degree program.

Over a half of the graduating students (55%) were employed in a pathology laboratory as a medical laboratory technician. Employment location across the state covered 1,800km and traversed 180km south (Gold Coast) to 1,600km north (Cairns) of the university.

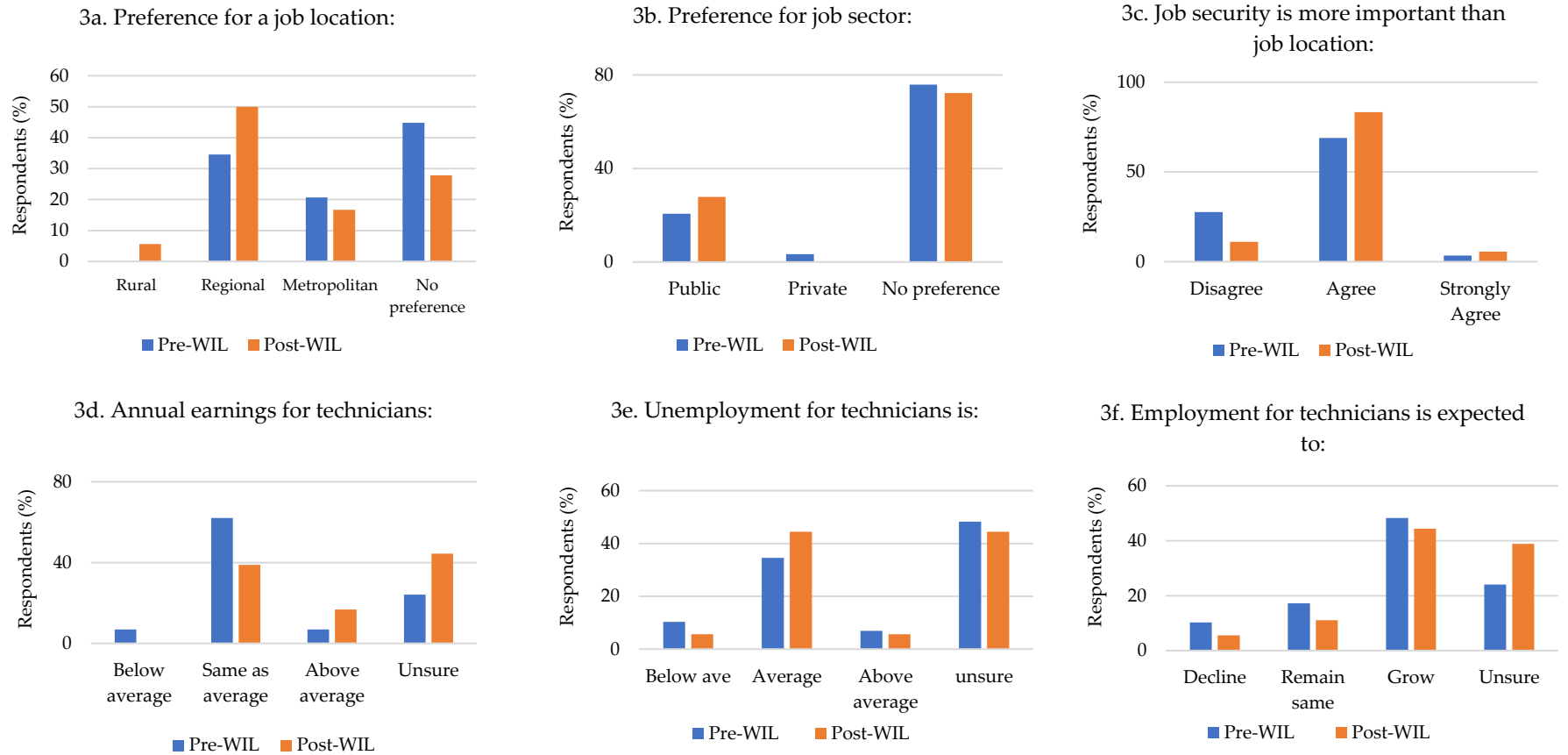


FIGURE 3: Student perceptions pre- and post-WIL. for: a) job location; b) job sector; c) job security; d) annual earnings for technicians; e) unemployment; and f) future employment.



Using the remoteness classification, the location of the twelve employed graduates was predominantly in a major city: RA1 – Major City (86%); followed by inner regional: RA2 – (7%) and outer regional locations: RA3 – (7%). There were no students employed in the pathology profession in remote or very remote areas. Six of the graduating students (21%) had not undertaken employment in the pathology industry or continued further education within the timeframe of the study. These students cited ‘other’ as an outcome preference (e.g., taking a break, a primary care role, and working as a technician in a non-medical pathology laboratory).

Figure 4 compares the students’ perceived graduate outcome post-WIL with their actual graduate outcome. There was no significant change in perceived versus actual outcomes in both preference for job sector and goals after graduation. Most students (75.9%) had not considered which sector they would work in but of those that had a preference, 20.7% believed they would work in the public sector, followed by 3.4% in the private sector. However, the graduate registry indicated that 36.4% (n=8) of the students gained employment in the public sector and 18.2% (n=4) in the private sector. Three of the four students who were studying part-time (and were yet to graduate) were concurrently employed in a public pathology laboratory or as a technician in a non-pathology laboratory.

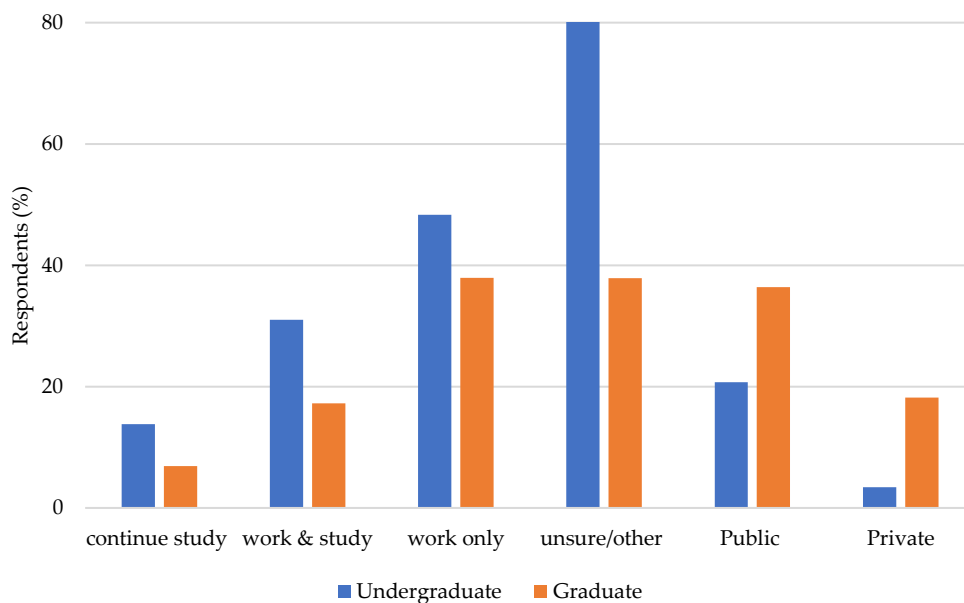


FIGURE 4: The perceived graduate outcomes for the students who participated in the study for employment in the pathology profession, further tertiary education and job sector (Public/Private) compared to their actual graduate outcome.

## DISCUSSION

It has been previously reported that graduate dissatisfaction with job environment and organizational structure needs to be addressed by academics who educate and train medical laboratory science students to prepare them for the workforce (Al-Enezi, Shah, Chowdhury, & Ahmad, 2008). Furthermore, tertiary education has a role to design curriculum that provides graduates with skills to promote life-long learning and career development (Patton & McMahon, 2006). This can be achieved through WIL, which in Australia, is now an essential component to prepare undergraduate students for competitive employment (Redden & Rauchle, 2012). For medical laboratory science, WIL can

provide essential skills in hands-on laboratory techniques with real patient samples and state-of-the-art equipment that tertiary education cannot provide.

Engagement and retention of students in the AssocDegMedLabSc program can be attributed to a perception of employment opportunities and integrity of the medical laboratory science workforce who provide good role modelling for students with associated industry influence (Miller, 2014). Nonetheless, WIL is likely to be a major influencing factor for motivation to complete the program and pursue a career as a medical laboratory science technician. WIL provides the skills and knowledge specific to the medical laboratory science profession which may not be taught in the classroom environment. However, these skills are listed as graduate attributes in university policies. Generic skills include communication, collaboration, problem solving, organization, applying technologies and information literacy. These generic skills are transferred in detailed work activities during WIL through a competency manual designed specifically for medical laboratory science and include: preparing and testing biological specimens to gather information about patient conditions; analyzing laboratory specimens to detect abnormalities; entering patient or treatment data into computers; operating laboratory equipment to analyze medical samples; collecting biological specimens from patients; performing quality control; and informing medical professionals regarding patient conditions and care (Australian Government Job Outlook, 2018).

The combined academic and industry WIL approach to program design was successful in this study. There were no differences between the responses pre-and post-WIL for the questions in the survey except for the question about salaries. Students also indicated that the subjects they completed prior to WIL prepared them for placement and were relevant for their pathology career. While a minority of students were anxious prior to a WIL placement, the post-WIL survey and the graduate registry contained only favorable comments and positive responses to employment and further study outcomes. With nearly two thirds of graduates employed in the pathology profession and almost a quarter continuing tertiary education in biomedical/medical laboratory science, attrition rate for this program was low at 19.8% (in 2014 attrition was the lowest in the School at 17.9%) and graduate employment was high (76% completion rate, 55% employment in pathology, 21% continuing education).

The importance of industry involvement in curriculum design for program success has been identified previously (Andre & Barnes, 2010). Results from our study indicated that students perceived that they were well-prepared for WIL and the role of the medical laboratory technician and this was attributable to a program that had industry input and core subjects that were designed to prepare the student for entry into the profession. This has again highlighted that industry recommendations that address the needs of the pathology workforce, along with the WIL required to achieve those skills, are essential for the success of graduates and the medical pathology industry.

At the time the AssocDegMedLabSc program was introduced, there were other encouraging events taking place in the pathology sector. These included the anticipated opening of a new \$1.8 billion tertiary teaching university hospital (Sunshine Coast University Hospital) in 2016 in regional Queensland. This hospital would provide the ideal environment in which to further develop a program in medical laboratory science for graduating pathology technicians and provide a world-class work-integrated learning environment with increasing employment opportunities and training for regional students. In 2013, a pathology awareness campaign 'Know pathology know healthcare' was formed to dismiss the "publicly perceived low value of pathology and the actual very high value of pathology to healthcare" (Know Pathology Know Healthcare, 2013). With over 19,000 people from 25 organizations

endorsing the campaign it was predicted pathology would in the future be promoted and increasingly perceived as a highly skilled medical profession providing high quality pathology services.

Nonetheless, coinciding with the commencement of the new AssocDegMedLabSc program in 2012, the public pathology sector began a period of change and an increasingly competitive market involving financial and employment restructuring. Specifically, public pathology in Queensland underwent a period of contestability during which rigid efficiency measures were employed that resulted in decreased staffing and a reduced number of vacancies. A meeting with Pathology Queensland and the Minister for Health (Scott, 2013) stated that the minister “was not wed to either private or public provision, just value for money”. This policy opened government service delivery to competition from alternative providers and Queensland Health initiated steps to “grow its partnerships with the private and not-for-profit sectors to deliver value for money, innovation and improved services based on alignment to the blueprint for better healthcare in Queensland”. This included contestability assessments for pathology (Warhurst, 2013). It was expected that the impact over a longer period would not be great; however, reducing overall payroll costs by employing more technicians and less scientists was an attractive feature that could be decided within individual pathology laboratories employing new staff.

In 2012, the forecast for job openings for medical laboratory technicians over five years was expected to be above average (between 25,001 and 50,000 jobs) and grow very strongly. Unemployment was predicted to be below average due to job openings arising from employment growth and senior staff leaving the occupation. In comparison, the number of job opportunities for medical laboratory scientists was expected to be low (between 10,001 and 25,000) with an increase in new medical scientist staff throughout Australia forecast as 1,200 by 2022. When the actual data was reported in 2017, the Australian employment rate for medical laboratory technicians was 33,200 with a projected increase to 39,800 by 2022. In contrast, only 23,800 medical laboratory scientists were employed in 2017 with a meagre increase to 25,000 in 2020 (Australian Government Job Outlook, 2018). These current high technician, and low scientist employment figures indicate that medical technicians are fulfilling a role in pathology services currently, and are likely to continue this involvement in the future.

Interestingly, the salary disparity between scientists and technicians in 2012 was large and continues to be in 2017. Most scientists have full-time employment (72%) and high earnings (\$1,469/week), while medical laboratory technicians have relatively low proportional full-time jobs (62%) and low earnings (\$900/week). In fact, the technician earnings are well below the all Australian jobs average of \$1,230/week (Australian Government Job Outlook, 2018). The disparity in earnings is also confounded by the historical and continuing gender inequality with regard to salaries in a workforce, which in pathology is predominantly females employed as medical technicians (81% female versus 19% male) (Australian Government Job Outlook, 2018). These gender statistics are representative of this study, with a high proportion of females graduating from the AssocDegMedLabSc program at USC.

Moreover, the role boundaries between scientists and technicians in Australian pathology services have been reported as ‘blurred’. Due to the similar and overlapping roles for scientists and technicians in the medical pathology service, it was reported that the scientific staff had a ‘lack of identity’ and were ‘poorly motivated’ (Badrick & St John, 2012). Contrasting this report on the medical scientist, the present study supported a positive pathway for the role of the technician. Students strongly agreed that they understood the role of the pathology technician, the career opportunities within their industry and positive employment opportunities.

It is proposed that the role of the technician versus the scientist may be influential in motivating the student pursuing a career in pathology to firstly, obtain an education as a technician (increased employability and job security) and then undertake further study during employment to become a scientist. This educational/employment combination has potential benefits for both the student and the pathology service. The student has the opportunity for paid employment after two years of study and the option to continue their education for one year to become a qualified scientist and keep their skills within the pathology profession. Due to the pathology industry involvement at the onset of the AssocDegMedLabSc program at USC, graduates are being employed without the need for the program to be nationally accredited. To date, only degrees in medical laboratory science are accredited nationally in Australia. The success of the associate degree at USC suggests that it is time to consider national accreditation for training at a pathology technician level.

Taking account of the current and future demands of the industry was important in the development of the AssocDegMedLabSc program. The WIL pathology technician model enabled students to gain experience across regional and metropolitan locations that not only enhanced employment but also helped address the industry concerns of a lack of training at a technical level necessary to meet the needs of a growing population with an expectancy of high quality health care. The cost benefit of employing technicians for the pathology service continues to be an attractive feature.

#### *Limitations*

The cohort of this study was small due to the sampling size available in a regional university, which would affect the generalizability of the overall findings. The small study relied on participants' perceptions of their expectations and experience pre- and post WIL and whether they obtained success as a graduate. Other methods of data collection, such as focus groups or semi-structured interviews that explored the students' experiences whilst completing WIL and as a graduate would have added depth to the study. However, given the geographical scale of WIL placement and employment sites, this would be difficult to accomplish for this study

#### CONCLUSION

Implementation of WIL in the AssocDegMedLabSc program at USC was a positive experience for the students, with very low attrition rates and excellent employment outcomes for graduate medical laboratory technicians. Students indicated that the two-year program adequately prepared them for 50-days of WIL placement in pathology services, and that they understood the role of the pathology technician before going on placement. This study demonstrated that industry partnership is integral in developing and maintaining WIL programs to ensure student satisfaction with the program, an understanding of the needs of the profession and setting achievable outcomes.

Further research exploring sustainability of WIL and managing the predicted growth in medical laboratory science is required. Medical laboratory science technician jobs are predicted to grow by as much as 20% by 2020. This would require an increase in workload for the academic and industry staff in medical laboratory science, along with the demand for placement sites that provide quality education and hands on learning. A possible solution is simulated WIL outside of pathology laboratories. This will require further research in partnership with industry to investigate new models of curriculum design that will provide quality WIL programs for training pathology technicians that meet the increasing needs of the pathology services and future population growth.

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