

Diagnostic radiography students' experience of safety during work integrated learning: A systematic review

JOHN TESSIER¹

HAMISH D. MCCARTHY

JOANNA BOHATKO-NAISMITH

University of Newcastle, Callaghan, Australia

Diagnostic radiography (DR) students undertake work integrated learning in a clinical environment as a requirement of their program. Recent investigation of young workers aged 15-24, identified this group as vulnerable to a wide range of work health and safety (WHS) complications and of decreased likelihood to report injuries. This review aimed to identify the WHS issues reported by DR students along with the underlying causes. A systematic review was undertaken including other allied health professions to evaluate potential WHS issues. This review was conducted to identify relevant literature from January 1993 to April 2020. Unexpectedly psychological WHS concerns related to emotional wellbeing and the quality of placement experience were more prevalent than physical injury. The underlying causes were complex and related to organizational support and the educational pedagogy adopted in diagnostic radiography. Recommendations include engaging with key stakeholders including students, clinical placement providers and tertiary institutions.

Keywords: Diagnostic radiography, students, workplace health and safety.

Work-integrated learning (WIL) is a model for the integration of higher education with a practical workplace experience (Billett, 2015). The key purpose of WIL is to develop the professional competence required for students to experience a smooth transition to the workforce, acquired by applying theory to practice in an authentic setting (Billett, 2015). Specific to health sciences, students develop problem solving skills, capacity for reflection and professional identity based on an understanding of the societal and cultural significance of healthcare (Berndtsson et al., 2020). Health students typically undertake WIL at an external clinical site alongside a qualified supervisor. The role of the supervisor is to oversee the development of a positive educational relationship with the student and to ensure they meet an appropriate standard of practice (Health Workforce Australia, 2013). The current model of diagnostic radiography (DR) WIL is a shared approach between faculty academic staff and currently practicing radiographers (Cunningham et al., 2015).

WIL is an integral part of most allied health programs and is considered an essential component of students' developing the skills necessary for work in their chosen profession (Jackson, 2018). For many students WIL may be their first encounter with a workplace, and they may therefore have little awareness of their Work, Health and Safety (WHS) obligations (Lindholm et al., 2019). Despite the benefits of WIL there is little known about student preparation in terms of WHS prior to a work placement. A recent Australian study identified the vulnerability of young workers regarding work-related injury and illness and breaches of their rights at work. The study findings proposed poor training in work, health and safety added to the high risk of injury among young workers (Paterson et al., 2015). While other studies emphasized age, lack of experience and more importantly young workers lack of knowledge as justification for high injury rates among young workers (Breslin et al., 2019; Safe Work Australia, 2020).

¹ Corresponding author: John Tessier, John.Tessier@newcastle.edu.au

Students or young workers make up a substantial part of the Australian workforce and are aged between 15 and 24 (Safe Work Australia, 2020). According to Safe Work Australia, in 2009-2010 workers under the age of 25 years accounted for 10% of the work-related injuries (Safe Work Australia, 2013). There is a high proportion of young workers in the DR workforce which indicates a high proportion of young individuals in student cohorts (Medical Radiation Practice Board of Australia, 2020a). A recent study by Clarkson et al identified that workers' compensation claims may not adequately reflect the difficulties encountered by young workers given the reduced likelihood of this age group to report WHS injuries (Clarkson et al., 2018). Moreover, this study raised concerns regarding the lack of reporting of injuries by young workers, citing lack of confidence, not wanting to cause a problem, potentially losing their job or being too frightened to report their injury as underlying factors (Clarkson et al., 2018).

The health industry is the fastest growing industry in NSW and has one of the highest rates of work-related injuries and illnesses reported each year, with the most common injuries reported as musculoskeletal disorders, falls at the same level, harassment and bullying and work pressure (SafeWork NSW, 2020). The DR workforce reports a high prevalence of back and neck pain due to a prevalence of repeated movements and awkward postures during procedures (Lorusso et al., 2007). In addition, DR workers must manage the unique potential for injury posed by ionizing radiation (Eatmon & Aaron, 2013). Recent evidence highlights the vulnerability of health workers undertaking WIL and further reports adverse health events associated with physical abuse, bullying, lack of supervision and psychological distress (Graj et al., 2019).

Student WHS is a contemporary issue and is well established in legislation pertaining to tertiary institutions and Australian Health Practitioner Regulation Agency (AHPRA) registered providers including hospitals and private practices (Medical Radiation Practice Board of Australia, 2020b; Tertiary Education Quality and Standards Agency, 2017). The ability of an allied health student to safely contribute to the workplace during placement has been identified as a key enabling factor in allowing providers to continue to support increasing demand for student placements and to ensure ongoing workforce supply (McBride et al., 2020). Despite having reported adequate knowledge of manual handling technique, students have reported role modelling of unsafe working practices and negative attitudes of supervising staff as barriers to the application of safe working practices (Ngo et al., 2013). As allied health professionals, diagnostic radiography students undertake WIL from the first year of their course and may not adequately report the full complement of WHS issues they encounter or successfully enact the safe working practices they have been taught at university. There is a current paucity of information regarding the experience of DR student during WIL (Boucalt & Howson, 2018; McAnulla et al., 2019; Ngo et al., 2013). Given the diverse range of WHS domains involved in DR education and the current lack of available consensus in literature, this review aimed to identify any WHS issues and barriers to safe working practices reported by DR students.

Research Questions

1. What are the WHS issues experienced by DR students undertaking WIL?
2. Do DR students encounter barriers to WHS behaviors during WIL?

Methods and Materials

Protocol and registration: This review was conducted in adherence the Preferred Reporting Items for Systematic Reviews (PRISMA) guidelines 2009.

Inclusion Criteria

- Populations: Undergraduate Diagnostic Radiography students enrolled in tertiary programs which incorporate WIL.
- Interventions: WIL, WHS training/ educational interventions.
- Comparators: Allied health students, students of varying experience levels, medical/ nursing students.
- Outcomes: Psychosocial WHS e.g., bullying and integration, technical WHS e.g., manual handling, safety during procedures, Psychological WHS e.g., stress, student reports on relationships with providers and tertiary institutions.

Study design: all study designs including randomized, non- randomized and qualitative designs; published in English language; published between January 1993 and April 2020. Studies conducted prior to 1993 were not considered due their inclusion of data collected prior to Diagnostic Radiography being registered as a graduate profession (Price, 2009).

Exclusion Criteria

- Population: Non- DR student.
- Intervention: Non- WIL related.
- Comparators: Non- allied health students, non- medical/ nursing students.
- Outcomes: Academic related outcomes e.g., stress due to academic coursework.

Study design: narrative style: editorial/ opinion based, no documented methods; published before January 1993; published in non- English language.

Search Strategy

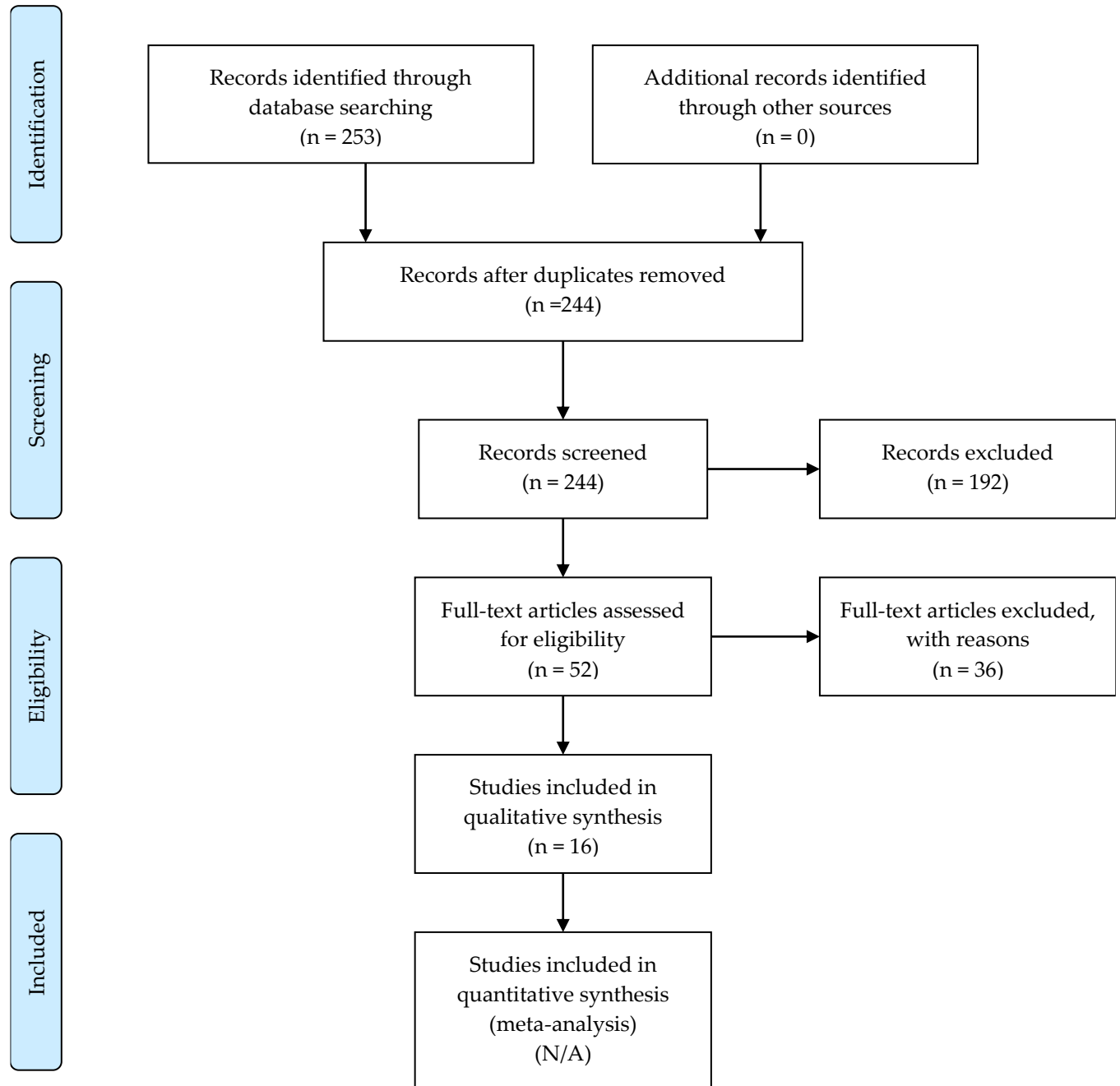
A literature search was conducted in the following four databases: CINAHL (Cumulative Index of Nursing and Allied Health Literature); Medline; EMBASE; and Cochrane Library. All studies identified were restricted to the English language and published between January 1993 and April 2020. Search terms included Radiologic technolog* OR (Diagnostic Radiograph* OR Medical Imag*), Student* (OR students, health occupations* OR students, public health* OR preceptor* OR student placement* or work integrated learn*), occupational health* OR (occupational safety* OR psychosocial* OR stress* OR musculoskeletal* OR risk*). Search terms were adapted to database specific filters for databases other than Medline.

Study Selection

A total of 253 records were identified after the initial database searches. No additional records were identified through other sources. After nine duplicates were removed, 244 abstracts remained for screening of which 192 were excluded with 52 records left for full text review. Following this, a further 36 records were excluded for various reasons including incorrect participant population, intervention type, setting, study design and not including relevant outcomes. The remaining 16 studies identified the following themes related to student WHS: professional and social immaturity, student practitioner relationships, manual handling, non-academic stressors and theory to practice gap. Figure 1 summarizes the flow of study selection as per the PRISMA guidelines (Moher et al., 2009). Full texts of studies determined for inclusion were retrieved and uploaded to Covidence systematic review software (2020) for screening. Two independent reviewers screened the titles and abstracts of all articles with

any conflicts resolved by a third independent reviewer. Full texts were assessed by two reviewers and those that did not satisfy the inclusion criteria were excluded.

FIGURE 1: PRISMA 2009 Flow Diagram.



Note. Adapted from "Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement," by D. Moher, A. Liberati, J. Tetzlaff, D. G. Altman, & PRISMA Group, 2009, *BMJ*, 339, b2535 (<https://doi.org/10.1136/bmj.b2535>). CC BY 4.0.

Data Extraction and Analysis

Participant intervention and outcome characteristics as well as data related to the safety of students undertaking medical radiation science education was extracted. This data included the following variables: characteristics of participant program of study, data collection, details of interventions related to clinical education, outcomes related to experience on placement and study design.

The following characteristics of the eligible studies were extracted and described; author/s, year of publication, participant characteristics, data collection, interventions, comparators, outcomes and study design. A single independent reviewer conducted data analysis by reading and summarizing the findings of each paper with the use of ENDNOTE X9 software.

Strategy for Data Synthesis

All results were described via narrative synthesis. The effect of workplace health and safety issues on students was not calculated and meta- analysis was not conducted.

Quality and Assessment

A systematic review was conducted using the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) checklist and diagram (see Figure 1). Of the included articles, 9 articles had a quantitative design and 7 articles a qualitative design. This checklist was used to assess the risk of bias, research design, and rigor of the included studies (See Table 1). Methodological quality assessments were undertaken using the Joanna Briggs Institute (JBI) critical appraisal tool for systematic reviews (2017).

Responses to the questions listed below are indicated in Table 1.

1. Is there congruity between the stated philosophical perspective and research methodology?
2. Is there congruity between the research methodology and the research question or objectives?
3. Is there congruity between the research methodology and the methods used to collect data?
4. Is there congruity between the methodology and the representation and analysis of data?
5. Is there congruity between the methodology and the interpretation of results?
6. Is there a statement locating the researcher culturally or theoretically?
7. Is the influence of the researcher on the research, and vice- versa, addressed?
8. Are participants, and their voices, adequately represented?
9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?
10. Do the conclusions in the research flow from the analysis, or interpretation, of the data?

TABLE 1: Methodological quality of studies using JBI critical appraisal tool checklist for systematic reviews.

		JBI Questions									
Study design	Study	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Cross sectional	McAnulla et al.	Y	Y	U/C	Y	Y	Y	Y	Y	Y	Y
	Dolbear, G	Y	Y	Y	U/C	N	N	N	N	U/C	Y
	Strudwick & Harvey-Lloyd	Y	Y	Y	U/C	N	N	N	N	U/C	Y
	Mason	Y	Y	Y	Y	N/A	N/A	Y	Y	U/C	Y
	Ingrassia	Y	Y	Y	Y	Y	Y	Y	Y	U/C	Y
	Boucalt & Howson	Y	Y	Y	Y	N	N	Y	Y	Y	Y
	Cohen & Legg	Y	Y	Y	Y	N	N/A	Y	Y	Y	Y
	Lawrance & Strudwick	Y	N	U/C	U/C	N	N/A	Y	N	U/C	Y
	Cooper	Y	Y	Y	Y	Y	U/C	Y	Y	U/C	Y
Literature review	Cunningham & Wright	Y	Y	Y	Y	N	N	N	Y	Y	Y
	Giordano	Y	Y	Y	U/C	N	N	N	U/C	N	Y
	Chavez	U/C	U/C	U/C	U/C	U/C	N	N	Y	N	Y
Quasi-experimental	Shiner	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cohort studies	Ngo et al.	Y	Y	Y	Y	Y	U/C	Y	Y	Y	Y
Qualitative research	Fortsch et al.	N/A	N/A	Y	Y	Y	Y	Y	Y	Y	N/A
Text & Opinion Papers	Eatmon	Y	Y	Y	Y	Y	U/C	N	N/A	N/A	N/A

Note. Y -yes, N -no, U/C -unclear, N/A -not applicable

RESULTS

Professional and Social Immaturity

Previous research has established that students experience stressors during clinical placements. The students reported feeling unprepared, fear of making a mistake or repeating the mistake, intimidation by clinical supervisors and difficult patients as the primary stressors during a placement (Mason, 2006). Students who encountered different clinical approaches to what they were taught at university identified feelings of unpreparedness as stressful (Fortsch et al., 2009). In addition, stressors pertaining to clinical supervisors were identified as poor communication, hurtful criticism, and negative responses to questions (Giordano, 2008; Mason, 2006)

Previous research has reported how relatively inexperienced students were inadequately prepared to balance the simultaneous demands of confronting patient presentations and radiation safety (Cooper, 2010; Shiner, 2019; Strudwick & Harvey-Lloyd, 2012). This resulted in excess levels of stress and decreases in emotional wellbeing of the affected students. A study conducted by Shiner, demonstrated changes consistent with burnout in a student following an encounter of an open wound (Shiner, 2019). Students who undertook simulation activities prior to placement reported pragmatic and unphased reactions following their first encounter with an open wound (Shiner, 2019). The student in the control group experienced a profound emotional reaction after viewing the open wound and reported that they "can't unsee" the injury. Following this incident, the student began to refer to patients by body parts,

a verbal practice which indicated loss of empathy (Shiner, 2019). Despite a desire to talk about their experiences, all students reported a lack of opportunity to debrief with clinical supervisors following their respective encounters (Shiner, 2019). Similar findings were reported by Cooper following a survey of e students engaged in a radiation biology course. Students reported a loss of empathy for patients, a lack of concern for patient radiation safety (n= 88%), alongside a higher correlation with statements deflecting responsibility to rules and higher authorities (Cooper, 2010). In addition, the study further highlighted this as an indicator of cognitive dissonance due to the students' identity as health professionals being confronted by the potential to cause patient harm (Cooper, 2010).

Student Practitioner Relationships

Students were found to experience difficulties with socially integrating with clinical staff across multiple studies (Dolbear, 2005; Mason, 2006; McAnulla et al., 2019). Mason identified poor organizational culture as an issue passed from staff to students (Mason, 2006). Similar findings were reported following a UK radiography program which identified low staff morale and issues with bullying and harassment of students by clinical staff as a key factor affecting the quality of student placements (Dolbear, 2005). Previous reviews have suggested that this was influenced by differing attitudes of tertiary institutions and providers regarding capacity to support student placement (Cunningham et al., 2015; Giordano, 2008). This study also highlighted that an open line of communication must be maintained to facilitate realistic expectations and even distribution of responsibility for student education (Dolbear, 2005). Poor student relationships with staff was identified as a potential risk factor for attrition, due to the potential to incite feelings of being unsuited to the job (McAnulla et al., 2019). Moreover, some students expressed fear of raising such issues about staff due to their awareness of the potential impact on their future career pathways (McAnulla et al., 2019). Interestingly, some students discussed how certain clinical staff were perceived as sources of support and would seek out particular radiographers for supervision (McAnulla et al., 2019). Students reported technical skills, approachability, and an ability to maintain a sincere educational relationship as key in having a positive experience with a supervisor (Ingrassia, 2011). Often, organizational factors including rostering, leave and clinical workload impacted on the availability of retaining a supervisor with these qualities (Ingrassia, 2011). The evidence also highlights the lack of formalized clinical educator positions in diagnostic radiography compared to other professions. The benefits to these positions include the availability of supervision from staff that are aware of the responsibilities of both educational institutions and clinical providers in clinical education (Cunningham et al., 2015; Ingrassia, 2011).

Manual Handling

Musculoskeletal disease (MSD) caused by biomechanically stressful manual handling procedures was reported as an established and costly WHS risk affecting the DR workforce (Chavez, 2005). Ngo et. al found that approximately half of a cohort of final year students (44/96) with knowledge of a wide range of manual handling techniques had experienced negative role modelling of correct technique where a clinical supervisor was dismissive or discouraged use of a biomechanically assistive device in patient transfers (Ngo et al., 2013). Students reported that this made them feel unsafe and they began to doubt the efficacy of safe manual handling devices (Ngo et al., 2013). A UK study reported students participating in patient slide procedures with inadequate personnel numbers resulting from time pressure enforced by clinical supervisors (Lawrance & Strudwick, 2010). This was of particular concern given the high rate of student participation in patient slide procedures identified across multiple studies (Boucalt & Howson, 2018; Lawrance & Strudwick, 2010; Ngo et al., 2013). Students also highlighted

that often there was a limited availability of equipment which prevented them from receiving the necessary training and experience with the use of mobile and ceiling hoists for patient transfers (Lawrance & Strudwick, 2010; Ngo et al., 2013). It should be noted that some sites which service predominantly ambulant patients may not stock this equipment and inadvertently limit opportunities for students to consolidate skills learned regarding their operation (Boucaut & Howson, 2018; Ngo et al., 2013).

Non- Academic Stressors

Non-academic stressors were broadly characterized as challenging events external to the educational setting and included financial hardship, interpersonal/ social problems, and adverse health events (Cohen & Legg, 2019; McAnulla et al., 2019). Students affected by non-academic stressors reported decreased levels of emotional wellbeing and were more likely to identify with survey constructs indicative of anxiety and depression (Cohen & Legg, 2019). Furthermore these factors influenced continuation decisions and increased levels of student attrition from undergraduate programs (McAnulla et al., 2019). Financial hardship was the most commonly reported non- academic stressor across studies (Cohen & Legg, 2019; McAnulla et al., 2019). Students reported experiencing difficulty with paying for accommodation, managing pre-existing work commitments and a limited opportunity to earn an income when tasked with travelling for clinical placement (McAnulla et al., 2019). Notably, students affected by financial hardship reported lower levels of emotional wellbeing (Cohen & Legg, 2019). Interpersonal relationships were also negatively impacted by social isolation enforced by clinical placement. Younger students reported struggling with social isolation due to "missing out" on the typical university experience while on clinical placement (McAnulla et al., 2019). Mature aged students reported comparatively greater stress due to isolation from spouses and children (Cohen & Legg, 2019).

Theory to Practice Gap

The relevance of student learning to clinical practice was related to the degree of cooperation between program officials and clinical staff (Fortsch et al., 2009; Giordano, 2008). A quality control initiative of a UK placement program found a low level of coordination between students' academic programs and their clinical education impacted students' ability to apply skills learned at university (Dolbear, 2005). One study commented on how an indirect line of communications between stakeholders limited student opportunities to practice safe manual handling techniques (Boucaut & Howson, 2018). Following successful peer teaching intervention students reported gaining skills in all safe patient transfer tasks immediately post intervention (88.2%) (Boucaut & Howson, 2018). Students reported use of approximately half of the learned skills on placement and were therefore over skilled (Boucaut & Howson, 2018). The authors commented on how clinical educators may not have been aware of student capabilities and therefore failed to provide opportunities for students to consolidate learned skills (Boucaut & Howson, 2018).

It was frequently reported that the quality of students' WIL experience was influenced by the cooperation of tertiary and provider institutions, the approaches of clinical supervisors and the individual learning styles of the students (Cunningham et al., 2015; Fortsch et al., 2009; Giordano, 2008; Ingrassia, 2011). Studies reported on various levels of integration between clinical and academic staff involved in coordinating students' WIL experience (Cunningham et al., 2015; Fortsch et al., 2009; Giordano, 2008; Ingrassia, 2011). A study conducted by Fortsch et al., identified interpersonal relationships with supervisors as a major contributing factor to the overall quality of WIL experience for students. This study included three different placement models that utilized variations in the

delivery of the academic and clinical aspects within their training programs. The internal program model involves academic content being delivered at the location where the clinical experience is undertaken. This required the imaging department to be a part of a hospital or clinic that has an internal education department which can facilitate both academic and clinical teaching. Two other program models included delivery of academic content at separate locations to where the clinical experience is gained. The bridging program model includes experience at one clinical site whereas the external program model utilizes multiple clinical sites for the training of each individual student. The relationship between student and supervisor was found to be important regardless of the placement model (Fortsch et al., 2009). Students from the internal model reported "fear of the unknown" due to being tasked with clinical duties before acquiring the necessary knowledge base. Students from the external model reported difficulty consolidating their knowledge due to disparity between coursework and the techniques used by their clinical supervisors (Fortsch et al., 2009). Students from the bridging model reported good continuity between their course work and clinical practice and a simple process of applying what they had learned in clinical practice.

DISCUSSION

In contrast to the expectation of identifying physical injuries, this systematic review revealed psychological injuries for DR students on WIL as prevalent WHS concerns.

Confronting experiences on practicum were shown to induce a loss of empathy in students. The low risk of reporting bias in the analyzed studies increased validity of this theme (Cooper, 2010; Shiner, 2019). While a level of emotional distance may be required for DR practitioners to adequately perform their duties, a lack of empathy may also be indicative of early career burnout (Shiner, 2019). This was consistent with a contemporary definition of burnout as a psychological syndrome induced by chronic job stress, which incorporates three key dimensions of exhaustion, cynicism and a sense of detachment from work (Maslach & Leiter, 2016). Burnout is a well-documented phenomenon in health workers and has strong propensity to decrease employee satisfaction and productivity, while simultaneously increasing turnover (García-Campayo et al., 2016). Mechanisms of burnout include both exposure to significant safety incidents and repeated exposure to minor events (Tawfik et al., 2019). It is therefore plausible to assume that early-stage students lacking in perspective regarding the diverse array of patient presentations in clinical practice may interpret routine occurrences as emotionally draining. The prevalence of burnout in the allied health workforce is a topic of current debate in the literature, however the tendency for students to under report suggests further investigation is required to determine its impact on students in the workplace (Clarkson et al., 2018; Tawfik et al., 2019). Furthermore, it is important that clinical placement providers and tertiary institutions remain sensitive to this phenomenon and be proactive in offering mental health support to students on placement.

This review identified the importance of clinical supervisors in role modelling the use of safe manual handling technique. This is highly significant in the context of recent investigation which identified how young workers' perceptions of injuries at work vary widely and can be influenced by the quality of training they receive. Supervising radiographers can act as an important source of reinforcement for safe working techniques and must not overlook their significance as an important source of safety education for students (Lewis & Robinson, 2003). Senior clinicians, often performing the clinical supervisor role, have indicated confidence in communicating and providing guidance to students, but due to various organizational factors, may have limited understanding of a student's academic programme and developing skills, and in some instances, have limited training in the supervision of students (Mather et al., 2015). Initiatives that develop a shared understanding of student learning needs

between tertiary and clinical institutions sites have been shown, despite the cost and administrative burden of clinical placement, to bolster support and maximize learning opportunities available to the student (Winchester-Seeto et al., 2016). In addition, the availability of manual handling equipment varied between clinical sites and inadvertently limited opportunities to practice safe working technique. This reinforces the importance of the quality of education students receive in maintaining their awareness of physical safety so that they may recognize safe manual handling across the array of clinical sites they may attend throughout their careers. It also reinforces the important role of tertiary institutions in ensuring clinical sites maintain adequate equipment for students to practice skills learned at university.

Student practitioner relationships were found to be highly influential towards student emotional wellbeing and engagement with workplace culture while on placement. Overall risk of bias was low which suggested that the perspectives exhibited in the studies were reflective of the clinical environment (Cunningham et al., 2015; Dolbear, 2005; Giordano, 2008; Ingrassia, 2011; Mason, 2006; McAnulla et al., 2019). Unfortunately, methodological quality was not adequately reported in all studies which limited the generalizability of findings (Cunningham et al., 2015; Dolbear, 2005; Giordano, 2008). Investigation of radiation therapists has identified a cyclical mechanism for the transfer of culture with the quality of experience of clinical supervisors during their own education shaping their perceptions of students in the workplace (Palmer & Naccarato, 2007). Given the interdisciplinary nature of some papers included in this review, findings regarding the experiences of radiation therapists were included for discussion (Cohen & Legg, 2019; Cooper, 2010). Furthermore the capabilities of diagnostic radiographers emphasize the acquisition of clinical competence over the development of the organizational culture and leadership skills required to adequately support student learning (Medical Radiation Practice Board of Australia, 2020b). The findings of this literature review suggest that to improve the quality of student practitioner relationships it may be necessary to implement formalized supervisor training programme for qualified diagnostic radiographers. It is recommended that this be integrated into continuing professional development initiatives.

Students undertaking placement were found to be negatively affected by a wide variety of non-academic stressors. Studies included in this theme had low risk of bias as well as high methodological quality (Cohen & Legg, 2019; McAnulla et al., 2019). This was consistent with evidence describing students of different backgrounds, engaging in clinical placement, whose quality of experience was influenced by their wellbeing, described as their individual social, psychological and financial resources (Gillett-Swan & Grant-Smith, 2018). An unexpected finding was the over representation of mature aged students in reporting the negative effect of non-academic stressors on emotional wellbeing (Cohen & Legg, 2019; McAnulla et al., 2019). This was consistent with the findings of wider literature which discussed how mature aged students experience stress due to difficulty in maintaining balance between their study responsibilities with their external responsibilities including family, romantic relationships and employment (Kahu et al., 2014). Task oriented/ problem focused coping mechanisms including planning daily activities and positively reframing adverse events have been identified as effective strategies in managing competing responsibilities and improving overall wellbeing (Rahim, 2019). In addition, interventions designed to shift student focus towards positive events including social connections, and reflecting on the university experience, have been shown to improve emotional wellbeing (Drewery et al., 2019). A survey of mature aged students showed a strong relationship between the use of problem based coping via planning and flourishing in the educational setting (Rahim, 2019). This was consistent with a survey of new student nurses in which students who utilized problem-based strategies demonstrated greater resilience and lower tendency to burnout

(Ching et al., 2020). It may be pertinent for tertiary institutions to implement training targeted to the teaching of problem based coping mechanisms to students undertaking placement.

Student education in Diagnostic Radiography was found to be affected by the presence of a theory to practice gap. This is a phenomenon by which students are unable to consolidate the theoretical knowledge learned on placement via application of learned skills in the clinical environment. Recent qualitative investigation has suggested that a theory to practice gap may be due to under confidence, with some students refraining from sharing their knowledge on placement for fear of being perceived as contradicting their supervisor (Higgins et al., 2017). Furthermore recent investigation of qualified radiographer's attitudes to evidence based practice has identified a still developing attitude to evidence based practice in the profession, a finding which can be extrapolated to the student educational setting wherein radiographers by being unwilling or unable to discuss recent research findings with students (Ahonen & Liikanen, 2010). This suggests a need for further Continuing Professional Development initiatives targeted to currently practicing radiographers based around integrating current research with practice and fostering positive educational relationships.

LIMITATIONS

This study will make a valuable contribution to the literature; however, it is not without limitations. Firstly, only studies in the English language were included which may have resulted in an incomplete representation of literature published internationally. Secondly, this research represents only the perspective of allied health students, it is important to consider the views of other stakeholders involved in WIL, such as the tertiary institution, clinical placement providers and other allied health disciplines. Future research would include a detailed review of the work, health, and safety concerns in consultation with all stakeholders, specifically students, prior to their first WIL placement.

CONCLUSION

The clinical education of diagnostic radiographers is a demanding process which requires extensive cooperation between tertiary institutions, providers, and students. This systematic review identified WHS issues encountered by students were predominately psychological rather than physical injuries. The underlying causes of these issues were multifactorial and influenced by the organizational support offered by key stakeholders in the WIL experience and the unique educational pedagogy utilized in DR education. It was unclear if this review encompassed the full range of WHS issues encountered by DR students. This was representative of the current paucity of literature available on this topic and highlights it as an area for further research. It is recommended that future studies engage with students, clinical placement providers and tertiary institutions due to their identity as key stakeholders in the WIL.

REFERENCES

- Ahonen, S.-M., & Liikanen, E. (2010). Radiographers' preconditions for evidence-based radiography. *Radiography*, 16(3), 217-222. <https://doi.org/https://doi.org/10.1016/j.radi.2010.01.005>
- Berndtsson, I., Dahlborg, E., & Pennbrant, S. (2020). Work-integrated learning as a pedagogical tool to integrate theory and practice in nursing education - An integrative literature review. *Nurse Education in Practice*, 42, Article 102685. <https://doi.org/10.1016/j.nepr.2019.102685>
- Billett, S. (2015). Integrating practice-based experiences with higher education. In S. Billett (Ed.), *Integrating practice-based experiences into higher education* (pp. 1-26). Springer. https://doi.org/10.1007/978-94-017-7230-3_1
- BoucAUT, R., & Howson, D. (2018). Teaching safe patient handling skills using a peer approach. *Radiologic Technology*, 90(1), 20-30.

- Breslin, F. C., Dollack, J., Mahood, Q., Maas, E. T., Laberge, M., & Smith, P. M. (2019). Are new workers at elevated risk for work injury? A systematic review. *Occupational Environmental Medicine*, 76(9), 694-701. <https://doi.org/10.1136/oemed-2018-105639>
- Chavez, C. (2005). Lifting safety and ergonomics. *Radiologic Technology*, 76(6), 469-472.
- Ching, S. S. Y., Cheung, K., Hegney, D., & Rees, C. S. (2020). Stressors and coping of nursing students in clinical placement: A qualitative study contextualizing their resilience and burnout. *Nurse Education in Practice*, 42, Article 102690. <https://doi.org/10.1016/j.nepr.2019.102690>
- Clarkson, L., Blewett, V., Rainbird, S., Paterson, J. L., & Etherton, H. (2018). Young, vulnerable and uncertain: Young workers' perceptions of work health and safety. *Work*, 61(1), 113-123. <https://doi.org/10.3233/WOR-182788>
- Cohen, T., & Legg, J. (2019). Emotional well-being and stress among radiologic science students. *Radiologic Technology*, 90(5), 450-458.
- Cooper, S. T. (2010). Radiation biology case studies and student empathy. *Radiation Therapist*, 19(1), 9-17.
- Cunningham, J., Wright, C., & Baird, M. (2015). Managing clinical education through understanding key principles. *Radiologic Technology*, 86(3), 257-273.
- Dolbear, G. (2005). Clinical placement: Capacity and quality. *Synergy: Imaging & Therapy Practice*, 19-22.
- Drewery, D. W., Cormier, L. A., Pretti, J. T., & Church, D. (2019). Improving unmatched co-op students' emotional wellbeing: Test of two brief interventions. *International Journal of Work-Integrated Learning*, 20(1), 43-53.
- Eatmon, S., & Aaron, L. (2013). Safety matters. *Radiologic Technology*, 84(4), 434-436.
- Fortsch, P., Henning, J. E., & Nielsen, L. E. (2009). Connecting classroom to clinical practice: A comparison of programs. *Radiologic Technology*, 81(2), 112-121.
- García-Campayo, J., Puebla-Guedea, M., Herrera-Mercadal, P., & Daudén, E. (2016). Burnout syndrome and demotivation among health care personnel. managing stressful situations: The importance of teamwork. *Actas Dermo-Sifiliográficas (English Edition)*, 107(5), 400-406. <https://doi.org/10.1016/j.adengl.2016.03.003>
- Gillett-Swan, J., & Grant-Smith, D. (2018). A framework for managing the impacts of work-integrated learning on student quality of life. *International Journal of Work-Integrated Learning*, 19(2), 129-140.
- Giordano, S. (2008). Improving clinical instruction: Comparison of literature. *Radiologic Technology*, 79(4), 289-296.
- Graj, E., Sheen, J., Dudley, A., & Sutherland-Smith, W. (2019). Adverse health events associated with clinical placement: A systematic review. *Nurse Education Today*, 76, 178-190. <https://doi.org/10.1016/j.nedt.2019.01.024>
- Health Workforce Australia. (2013). *National clinical supervision competency resource*. Australian Government
- Higgins, R., Hogg, P., & Robinson, L. (2017). Research informed teaching experience in diagnostic radiography: The perspectives of academic tutors and clinical placement educators. *Journal of Medical Imaging and Radiation Sciences* 48(3), 226-232. <https://doi.org/10.1016/j.jmir.2017.06.002>
- Ingrassia, J. M. (2011). Effective radiography clinical instructor characteristics. *Radiologic Technology*, 82(5), 409-420.
- Jackson, D. (2018). Developing graduate career readiness in Australia. *Industrial Health*, 53, 293-299.
- Kahu, E. R., Stephens, C., Zepke, N., & Leach, L. (2014). Space and time to engage: Mature-aged distance students learn to fit study into their lives. *International Journal of Lifelong Education*, 33(4), 523-540. <https://doi.org/10.1080/02601370.2014.884177>
- Lawrance, W., & Strudwick, R. (2010). To lift or not to lift. *Synergy: Imaging & Therapy Practice*, 20-22.
- Lewis, S. J., & Robinson, J. W. (2003). Role model identification by medical radiation science practitioners—A pilot study. *Radiography*, 9(1), 13-21. [https://doi.org/https://doi.org/10.1016/S1078-8174\(02\)00077-9](https://doi.org/https://doi.org/10.1016/S1078-8174(02)00077-9)
- Lindholm, M., Vayrynen, S., & Reiman, A. (2019). Findings and views on occupational safety and health teaching at universities. *Work*, 64(4), 685-695. <https://doi.org/10.3233/WOR-193030>
- Lorusso, A., Bruno, S., & L'Abbate, N. (2007). Musculoskeletal complaints among Italian X-ray technologists. *Industrial Health*, 45(5), 705-708.
- Maslach, C., & Leiter, M. P. (2016). Understanding the burnout experience: Recent research and its implications for psychiatry. *World psychiatry : official journal of the World Psychiatric Association (WPA)*, 15(2), 103-111. <https://doi.org/10.1002/wps.20311>
- Mason, S. L. (2006). Radiography student perceptions of clinical stressors. *Radiologic Technology*, 77(6), 437-450.
- Mather, C. A., McKay, A., & Allen, P. (2015). Clinical supervisors' perspectives on delivering work integrated learning: A survey study. *Nurse Education Today*, 35(4), 625-631. <https://doi.org/10.1016/j.nedt.2014.12.021>
- McAnulla, S. J., Ball, S. E., & Knapp, K. M. (2019). Understanding student radiographer attrition: Risk factors and strategies. *Radiography* 26(3), 198-204.
- McBride, L. J., Fitzgerald, C., Costello, C., & Perkins, K. (2020). Allied health pre-entry student clinical placement capacity: Can it be sustained? *Australian Health Review*, 44(1), 39-46. <https://doi.org/10.1071/AH18088>
- Medical Radiation Practice Board of Australia. (2020a). *Medical Radiation Practice Board of Australia registrant data*. <https://www.medicalradiationpracticeboard.gov.au/News/Statistics.aspx>
- Medical Radiation Practice Board of Australia. (2020b). *Professional capabilities for medical radiation practitioners*. <https://www.medicalradiationpracticeboard.gov.au/Registration-Standards/Professional-Capabilities.aspx>

- Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *BMJ*, 339, b2535. <https://doi.org/10.1136/bmj.b2535>
- Ngo, M., Schneider-Kolsky, M., & Baird, M. (2013). The attitudes of Australian radiography students towards the use of assistive transfer devices to reduce biomechanical stress in the clinical setting. *Radiography*, 19(2), 125-129. <https://doi.org/10.1016/j.radi.2013.01.003>
- Palmer, C., & Naccarato, N. (2007). Differences in radiation therapy staff and students' perceptions of clinical teaching characteristics. *Journal of Radiotherapy in Practice*, 6(2), 93-102. <https://doi.org/10.1017/S1460396907006012>
- Paterson, J. L., Clarkson, L., Rainbird, S., Etherton, H., & Blewett, V. (2015). Occupational fatigue and other health and safety issues for young Australian workers: An exploratory mixed methods study. *Industrial Health*, 53(3), 293-299.
- Price, R. (2009). Diploma to degree 1976 to 1993. *Radiography*, 15(Suppl 1), e67-e71. <https://doi.org/10.1016/j.radi.2009.10.007>
- Rahim, N. B. (2019). Work-family conflict, coping strategies, and flourishing: Testing for mediation. *Asian Academy of Management Journal*, 24(2), 169-195. <https://doi.org/10.21315/aamj2019.24.2.8>
- Safe Work Australia. (2013). *Work-related injuries experienced by young workers in Australia, 2009–10*.
- Safe Work Australia. (2020, May 15). *Young workers*. Retrieved August 19, 2020, from <https://www.safeworkaustralia.gov.au/young-workers>
- SafeWork NSW. (2020). *Health care and social assistance*. NSW Government. <https://www.safework.nsw.gov.au/your-industry/health-care-and-social-assistance>
- Shiner, N. (2019). Can simulation impact on first year diagnostic radiography students' emotional preparedness to encounter open wounds on their first clinical placement: A pilot study. *Radiography*, 25(4), 294-300. <https://doi.org/10.1016/j.radi.2019.04.009>
- Strudwick, R. M., & Harvey-Lloyd, J. M. (2012). Ready or not? How prepared are diagnostic radiography students for their first practice placement? A small scale study in one university. *Synergy: Imaging & Therapy Practice*, 25-30.
- Tawfik, D. S., Scheid, A., Profit, J., Shanafelt, T., Trockel, M., Adair, K. C., Sexton, J. B., & Ioannidis, J. P. A. (2019). Evidence relating health care provider burnout and quality of care: A systematic review and meta-analysis. *Annals of Internal Medicine*, 171(8), 555-567. <https://doi.org/10.7326/M19-1152>
- Tertiary Education Quality and Standards Agency. (2017). *Guidance note: Work integrated learning*. Australian Government. <https://www.teqsa.gov.au/sites/default/files/guidance-note-work-integrated-learning-v2-0.pdf>
- Winchester-Seeto, T., Rowe, A., & Mackaway, J. (2016). Sharing the load: Understanding the roles of academics and host supervisors in work-integrated learning. *Asia-Pacific Journal of Cooperative Education*, 17(2), 101-118.



About the Journal

The International Journal of Work-Integrated Learning (IJWIL) publishes double-blind peer-reviewed original research and topical issues related to Work-Integrated Learning (WIL). IJWIL first published in 2000 under the name of Asia-Pacific Journal of Cooperative Education (APJCE).

In this Journal, WIL is defined as:

An educational approach involving three parties – the student, educational institution, and an external stakeholder – consisting of authentic work-focused experiences as an intentional component of the curriculum. Students learn through active engagement in purposeful work tasks, which enable the integration of theory with meaningful practice that is relevant to the students' discipline of study and/or professional development (Zegwaard et al., 2023, p. 38).*

Examples of practice include off-campus workplace immersion activities such as work placements, internships, practicum, service learning, and cooperative education (co-op), and on-campus activities such as work-related projects/competitions, entrepreneurship, student-led enterprise, student consultancies, etc. WIL is related to, and overlaps with, the fields of experiential learning, work-based learning, and vocational education and training.

The Journal's aim is to enable specialists working in WIL to disseminate research findings and share knowledge to the benefit of institutions, students, WIL practitioners, curricular designers, and researchers. The Journal encourages quality research and explorative critical discussion that leads to the advancement of quality practices, development of further understanding of WIL, and promote further research.

The Journal is financially supported by the Work-Integrated Learning New Zealand (WILNZ; www.wilnz.nz), and the University of Waikato, New Zealand.

Types of Manuscripts Sought by the Journal

Types of manuscripts sought by IJWIL is primarily in two forms: 1) *research publications* describing research into aspects of work-integrated learning and, 2) *topical discussion* articles that review relevant literature and provide critical explorative discussion around a topical issue. The journal will, on occasions, consider good practice submissions.

Research publications should contain; an introduction that describes relevant literature and sets the context of the inquiry. A detailed description and justification for the methodology employed. A description of the research findings - tabulated as appropriate, a discussion of the importance of the findings including their significance to current established literature, implications for practitioners and researchers, whilst remaining mindful of the limitations of the data, and a conclusion preferably including suggestions for further research.

Topical discussion articles should contain a clear statement of the topic or issue under discussion, reference to relevant literature, critical and scholarly discussion on the importance of the issues, critical insights to how to advance the issue further, and implications for other researchers and practitioners.

Good practice and program description papers. On occasions, the Journal seeks manuscripts describing a practice of WIL as an example of good practice, however, only if it presents a particularly unique or innovative practice or it was situated in an unusual context. There must be a clear contribution of new knowledge to the established literature. Manuscripts describing what is essentially 'typical', 'common' or 'known' practices will be encouraged to rewrite the focus of the manuscript to a significant educational issue or will be encouraged to publish their work via another avenue that seeks such content.

By negotiation with the Editor-in-Chief, the Journal also accepts a small number of *Book Reviews* of relevant and recently published books.

Reference

Zegwaard, K. E., Pretti, T. J., Rowe, A. D., & Ferns, S. J. (2023). Defining work-integrated learning. In K. E. Zegwaard & T. J. Pretti (Eds.), *The Routledge international handbook of work-integrated learning* (3rd ed., pp. 29-48). Routledge. <https://doi.org/10.4324/9781003156420-4>



International Journal of Work-Integrated Learning

ISSN: 2538-1032

www.ijwil.org

EDITORIAL BOARD

Editor-in-Chief

Assoc. Prof. Karsten Zegwaard

University of Waikato, New Zealand

Associate Editors

Assoc. Prof. Bonnie Dean

University of Wollongong, Australia

Dr. David Drewery

University of Waterloo, Canada

Assoc. Prof. Jenny Fleming

Auckland University of Technology, New Zealand

Assoc. Prof. Sonia Ferns

Curtin University, Australia

Dr. Judene Pretti

University of Waterloo, Canada

Dr. Anna Rowe

University of New South Wales, Australia

Senior Editorial Board Members

Dr. Craig Cameron

University of the Sunshine Coast, Australia

Dr. Phil Gardner

Michigan State University, United States

Assoc. Prof. Kathryn Hay

Massey University, New Zealand

Prof. Denise Jackson

Edith Cowan University, Australia

Assoc. Prof. Ashly Stirling

University of Toronto, Canada

Emeritus Prof. Janice Orrell

Flinders University, Australia

Emeritus Prof. Neil I. Ward

University of Surrey, United Kingdom

Dr. Theresa Winchester-Seeto

University of New South Wales, Australia

Copy Editor

Diana Bushell

International Journal of Work-Integrated Learning

IT Support

Erik van der Gaag

International Journal of Work-Integrated Learning

REVIEW BOARD

Assoc. Prof. Erik Alanson, University of Cincinnati, United States

Assoc. Prof. Martin Andrew, Otago Polytechnic, New Zealand

Prof. Dawn Bennett, Curtin University, Australia

Dr. Roelien Brink, Tshwane University of Technology, South Africa

Mr. Matthew Campbell, University of Queensland, Australia

Assoc. Prof. Clare Dannenberg, University of Canterbury, New Zealand

Dr. Julia Caldicott, Southern Cross University, Australia

Prof. Leigh Deves, Charles Darwin University, Australia

Prof. Michelle Eady, University of Wollongong, Australia

Dr. Alon Eisenstein, University of British Columbia, Canada

Assoc. Prof. Chris Eames, University of Waikato, New Zealand

Assoc. Prof. Wendy Fox-Turnbull, University of Waikato, New Zealand

Dr. Nigel Gribble, Curtin University, Australia

Prof. Rachael Hains-Wesson, RMIT University, Australia

Dr. Lynette Hodges, Massey University, New Zealand

Dr. Katharine Hoskyn, Auckland University of Technology, New Zealand

Dr. Nancy Johnston, Simon Fraser University, Canada

Dr. Julian Lee, RMIT University, Australia

Dr. Patricia Lucas, Auckland University of Technology, New Zealand

Dr. Jaqueline Mackaway, Macquarie University, Australia

Prof. Andy Martin, Massey University, New Zealand

Dr. Norah McRae, University of Waterloo, Canada

Dr. Katheryn Margaret Pascoe, University of Otago, New Zealand

Dr. Laura Rook, University of Wollongong, Australia

Assoc. Prof. Philip Rose, Hannam University, South Korea

Dr. Leoni Russell, RMIT, Australia

Dr. Jen Ruskin, Macquarie University, Australia

Dr. Andrea Sator, Simon Fraser University, Canada

Dr. David Skelton, Eastern Institute of Technology, New Zealand

Assoc. Prof. Calvin Smith, University of Queensland, Australia

Assoc. Prof. Judith Smith, Queensland University of Technology, Australia

Dr. Raymond Smith, Griffith University, Australia

Prof. Roger Strasser, Simon Fraser University, Canada

Dr. Kylie Taffard, University of Canterbury, New Zealand

Prof. Yasushi Tanaka, Kyoto Sangyo University, Japan

Dr. Raewyn Tudor, University of Canterbury, New Zealand

Dr. Faith Valencia-Forrester, Charles Sturt University, Australia

Dr. Thai Vu, Curtin University, Australia

Ms. Genevieve Watson, Elysium Associates Pty, Australia

Dr. Nick Wempe, Primary Industry Training Organization, New Zealand

Prof. Chris Winberg, Cape Peninsula University of Technology, South Africa

Dr. Karen Young, Deakin University, Australia

Publisher: Work-Integrated Learning New Zealand (WILNZ)

www.wilnz.nz

Copyright: CC BY 4.0