Employability initiatives in undergraduate education and application to human nutrition: A scoping review

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Abstract

Human nutrition is a growing field with an increasing job market and high demand for university study, yet graduates report feeling underprepared for and unaware of potential job opportunities. This scoping review aimed to identify employment initiatives used in undergraduate programs to support an evidence-based approach to the development of future initiatives for human nutrition courses. The scoping review following PRISMA-ScR criteria was initially conducted in October 2018 and updated in April 2020. Search terms were selected to identify studies that reported on employability or work-readiness embedded within the course curriculum for undergraduate students. Fourteen papers met the eligibility criteria. Papers included were from Australia (9), United Kingdom (2), United States (1), New Zealand (1) and Germany (1). Papers described initiatives fitting broad categories of placements, project-based industry collaboration, practice-based eLearning, mentoring and building graduate attributes. Placements were the most common type of initiative and project-based industry collaboration demonstrated the highest levels of student and employer satisfaction. The success of initiatives was often attributed to incorporating diverse approaches to real-world, problem-solving skills. Mentoring and eLearning were used to promote employability soft skills, while industry-based placements provided students with practical experience. Placement in specific workplace settings should be representative of the diverse job options for nutrition graduates. Human nutrition degrees should consider incorporating strategies that develop soft skills and project-based skills while exposing students to diverse workplace settings within industry.

Keywords:
employability, work readiness, undergraduate, nutrition

Introduction

In recent years there has been an increased interest and enrolment in human nutrition courses offered in higher education. For example, a new online human nutrition degree program was offered beginning in 2016 at our institution and saw overall degree enrolments in human nutrition jump from 157 to more than 10,000 in 2020 (L. Ayers, personal communication, May 27, 2020). In

addition, there are more opportunities to work in nutrition-related roles than ever before (Australian Government, 2019). However, graduates without paid or volunteer work experience may have a poor understanding of the type of work available including non-traditional roles that utilise skills and knowledge developed through their studies (Hughes & Desbrow, 2005). Students may be unaware of their scope of practice and expectations of these roles and may lack skillsets desired by employers. Faced with uncertainty about their career prospects, we have observed students reporting high levels of anxiety and frequently requesting work experience as part of their degree. As lecturers in a human nutrition program, seven of the authors have observed the impact this anxiety has on students' perceived self-employability.

There are different models for work experience; embedded into the curriculum of an undergraduate degree program, optional or competitive extracurricular programs, and private arrangements between students and industry. Work-integrated learning (WIL) is an increasingly common component of undergraduate health programs (Abery, Drummond, & Bevan, 2015). Work-integrated learning integrates theory and practice knowledge through a practice-based approach such as placements in the industry (Orrell, 2011). Often, WIL entails a single subject or a semester of work placement where students participate in work-related activities in an industry setting while completing tasks and assessments required for credit within their undergraduate program. These arrangements enable universities to provide a consistent approach to developing intended learning outcomes and diverse real-world experiences with participating industry partners.

In many health programs, placements are undertaken where students engage in professional activities in relevant settings, are supervised by senior practitioners, and are required to demonstrate competency against entry-level professional standards. With no practice-based competency standards for human nutrition graduates, professional placements are unsuitable for generalist nutrition programs in Australia. Instead, private arrangements between students and industry are common for short-term work experience. However, without consistent structure or guidance, variability in the outcomes of these arrangements can occur. Initiatives to foster student employability embedded into undergraduate programs are attractive to students (Tymon, 2013) and are likely to support student satisfaction and retention.

While there is no consensus on the definition of employability, there are recognised common factors in the form of skills and/or practices. These include lifelong learning, professional practices and standards, informed decision making, commencement readiness, collaboration, and integration of theory and practice (Sumanasiri, Yajid, & Khatibi, 2015; Smith, Ferns, & Russell, 2014). These factors may be developed through gaining knowledge, skills and experiences in a range of settings and programs. Many universities now embed employability skills development into curriculum for all programs.

There is a dearth of literature on employability initiatives specifically for undergraduate programs in nutrition. This scoping review aims to identify what employability initiatives have been adopted in undergraduate degree programs, and to ascertain the feasibility and effectiveness of these initiatives in the nutrition discipline. Results from this review will inform the development of future employability initiatives for undergraduate nutrition programs.

Methods

Protocol

The protocol for this scoping review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) (Tricco, 2018). The scoping review methodology followed the validated Joanna Briggs Institute (JBI) screening tool (JBI, 2015) and synthesis of seminal frameworks (Arksey & O'Malley, 2005; Levac, Colquhoun, & O'Brien, 2010). The

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definition and method for conducting scoping reviews were standardised through the development of the PRISMA-ScR guidelines (Tricco, 2018). Although optional in the PRISMA-ScR guidelines, a quality assessment was included in this review.

Eligibility criteria

Due to the broad nature of scoping reviews, all study designs were included. Eligibility criteria were developed using the JBI (JBI, 2015) guidelines using the Participants, Concept and Context acronym by three team members (EM, AF and AB).

- *Participants*: Undergraduate university students studying in any discipline. This target population was widened after prospective searching for university students studying nutrition did not yield sufficient citations.
- *Concept*: How universities promote the employability or work-readiness of their students. The terms employability and work-readiness were used interchangeably.
- *Context*: Employability or work-readiness initiatives needed to be described and embedded within the university course curriculum. Extracurricular initiatives were not included in this review.

Information sources and search strategy

A comprehensive literature search was conducted in October 2018 and updated in April 2020 with assistance from a university librarian. Five electronic databases were searched (ProQuest Central, Web of Science, ERIC, CINAHL, SCOPUS). The search strategy combined the keywords 'curricul*' AND 'work-ready' AND 'higher education' AND 'design*'. All study designs were included; no date filter was applied; only English language papers were included. Informit and TRIP databases were searched for grey literature.

Study selection process

Initial screening of titles and abstracts was conducted by one researcher (EM) to maintain consistency. Each full-text article was independently reviewed by two researchers (a combination of EM, AF, AN and JB), discrepancies were sent to a third researcher (AB) for resolution. Excluded articles were either irrelevant or did not meet the eligibility criteria (Figure 1, below).

Data extraction and charting

Data extraction focused on study characteristics, research objectives and outcomes related to graduate employability initiatives (Table 1, p. 75). Two researchers (EM and SM) independently extracted data addressing criteria of; location, target population, sample size, duration, design type, curriculum initiative description, research objectives, main outcome measures and results. Both researchers added their comments to the table, any discrepancies were resolved via email.

Assessment of quality

Study quality was assessed independently by two researchers (EM and SM) using the Critical Appraisal Skills Programme (CASP) qualitative checklist (CASP, 2009). Three overarching sections considered the validity of results, what the results were and whether the results would help locally. Results were collated (Table 2, p. 78), discrepancies discussed and resolved.
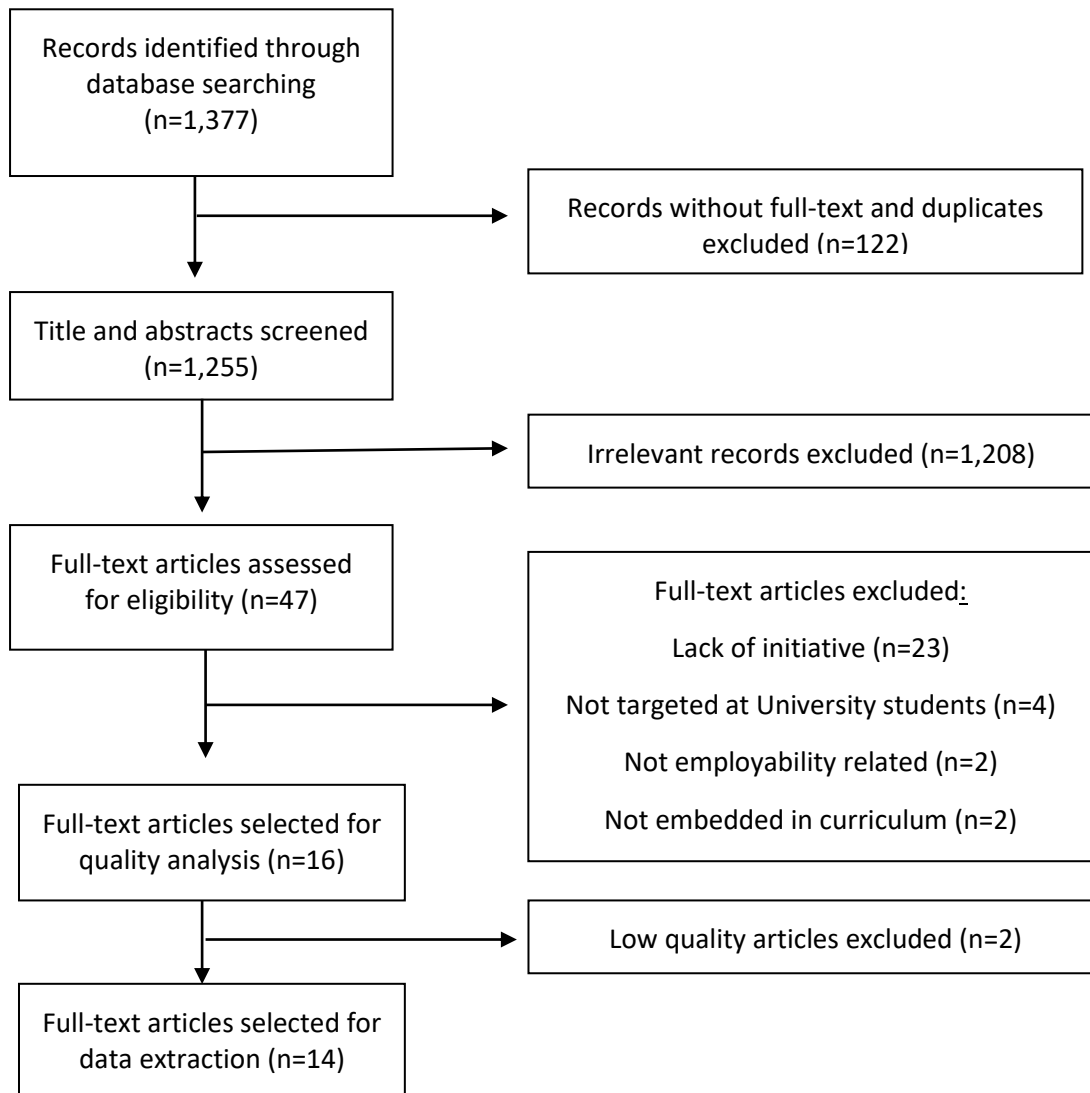
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Records identified through
database searching
(n=1,377)
                          →    Records without full-text and duplicates
                               excluded (n=122)

Title and abstracts screened
(n=1,255)
                          →    Irrelevant records excluded (n=1,208)

Full-text articles assessed
for eligibility (n=47)
                          →    Full-text articles excluded:
                               Lack of initiative (n=23)
                               Not targeted at University students (n=4)
                               Not employability related (n=2)
                               Not embedded in curriculum (n=2)

Full-text articles selected for
quality analysis (n=16)
                          →    Low quality articles excluded (n=2)

Full-text articles selected for
data extraction (n=14)
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Figure 1: Flow Chart of the Article Search and Selection Stages

Synthesis

Reviewers completed data extraction from the selected articles and data was transferred to a table (Table 1, p. 75). As the primary goal was to identify the type, feasibility and applicability of initiatives, studies were described and analysed by the initiative type, objective of the initiative or research objective and outcomes measured.

Results

The search yielded 1,377 results. Of these, 64 citations met the eligibility criteria based on title and abstract. Conference proceedings, post-graduate dissertations and newspaper articles were excluded. From the 64 full-text articles reviewed, 16 articles met the eligibility criteria and subsequently underwent quality assessment. After quality assessment was completed, two articles were excluded from the final review: one (Collis, Foth, & Schroeter, 2009) did not evaluate views of stakeholders or report results from the initiative; and the other (Richards & Marshall, 2019) did not have a clear objective for their research and the reported results lacked relevance to employability.

The remaining 14 studies included in the final analysis scored highly on the CASP Qualitative Checklist (Table 2, p. 78). Two of the 10 questions included in the checklist showed ambiguity. The questions, 'Has the relationship between researcher and participants been adequately considered?' and 'Have ethical issues been taken into consideration?' were difficult to ascertain as the possibility of coercion was not directly addressed in many articles where teaching staff investigated student outcomes. Not all studies included ethics approval information. However, given the journals they were published in required ethics approval for submission, it was assumed that ethics had been adequately considered.

General characteristics of included initiatives

General employability initiative characteristics adopted in undergraduate programs are detailed in Table 1 (see p.75). Studies included in this review were conducted in Australia (n=9), United Kingdom (n=2), United States (n=1), New Zealand (n=1) and Germany (n=1). Employability initiatives included a range of approaches of institutional-arranged and self-sourced placements (Aprile & Knight, 2019; Cord & Clements, 2010; Elijido-Ten & Kloot, 2015; Fleming & Haigh, 2017; Fletcher-Brown, Knibbs & Middleton, 2015; Jackson & Collings, 2018; Rawlinson & Dewhurst, 2013), project-based industry collaborations as part of WIL programs (Brimble et al., 2012; Gilbert, 2012; Keogh, Sterling, & Venables, 2007; Martinez Leon, 2019), practice-based eLearning (Blackburn, 2017), mentoring programs (Jenkinson & Benson, 2016), and the development of a framework for students to master graduate attributes over time (Windsor, Rutter, McKay, & Meyers, 2014). Most studies presented the views of students, institutions and industry and included evaluations of student and institutional outcomes. Initiatives varied in the number of students included in the evaluation [n=28 (Cord & Clements, 2010) to n=865 (Jackson & Collings, 2018)], and duration of the initiative [16 days (Cord & Clements, 2010) to three-year degrees (Brimble et al., 2012)]. Overall, there were a diverse range in both type of workplace used and types of initiatives; the findings of these are summarised and evaluated in the following sections.

Placements

The most common initiatives described were work-based placements, where senior undergraduate students worked for varying periods in the industry or profession to gain work experience prior to graduation. Placements varied in models and collaborative processes yet showed similarity in reported outcomes. A case study reported in the accounting discipline explored a non-compulsory six or 12 month paid WIL structure, delivered in combination with pre-placement processes and training, supervision and performance reviews (Elijido-Ten & Kloot, 2015). The pre-placement process included information sessions and seminars on the WIL process, resume and application writing, training on generic work skills and workforce expectations. Workplace training included company-specific inductions and courses. Students were also paired with an academic mentor for additional support. Placement supervision, training and performance evaluations were conducted by the employer. Employers reported improved soft skills such as teamwork, ability to work to deadlines, managing the supervisor relationship and contribution to a reinvigorated workplace atmosphere from students. Students indicated that the experience gave them an employment advantage of having knowledge and skills that others would need additional time to develop. Larger employers contributed more to employment outcomes by hiring 80-90% of WIL graduates.

Stakeholder views of WIL were examined in a sport education placement that involved 350 hours of unpaid self-sourced work experience during the final year of an undergraduate degree (Fleming & Haigh, 2017). Results from questionnaires and surveys indicated that skills obtained from a workplace setting such as effective communication and teamwork were complementary to the theoretical knowledge obtained in the university setting.

Student perspectives of compulsory teacher education placements as well as their perceived readiness for a career in the teaching profession were analysed by Aprile and Knight (2019). Identified benefits included not just the development of skills for practical competence, but also greater awareness of their future roles and a sense of responsibility to the profession. Professional preparedness was negatively influenced by relationships with workplace supervisors and performance pressure associated with assessment during placements.

Fletcher-Brown et al. (2015) reported increased confidence, problem-solving and teamwork skills from students through live-client learning activities. Live-client activities included existing or potential business problems or projects directed by industry organisations. The quality and value of work performed by students exceeded expectations from industry partners.

Jackson and Collings (2018) reported graduate employment outcomes at four and 16 months from two undergraduate cohorts in 2013 and 2015. Although approximately one third of each cohort completed WIL during their studies, no differences were found in the rates of full-time employment between students who had completed WIL and those who had not. However, students who completed WIL perceived their roles to reflect their qualifications, while their counterparts were more likely to report feeling over-qualified.

Finally, Rawlinson and Dewhurst (2013) used learning laboratories to simulate the placement experience for tourism and hospitality vocational degrees. The learning labs were a collaboration between university and industry to provide students with an opportunity to deliver a commercial service under supervision. Although employment was not directly assessed via job status, the success of the initial trial lab resulted in students and industry partners reporting increased student employment skills such as communication and teamwork and an increase in graduate employment support and opportunities from industry partners. Ongoing success of these labs were attributed to using local employers who offered support and resources in the form of internship concepts, information on internal operation processes, management and training programs and representation on the university advisory board. Additionally, the use of operating manuals provided clarity in the roles and responsibilities of the employer, the university and the students, and the use of one tutor as a single point of contact aided communication between all parties.

Project-based industry collaboration

Four studies (Brimble et al., 2012; Gilbert, 2012; Jenkinson & Benson, 2016; Martinez Leon, 2019) explored collaborations between institutions, students and industry in the development of new undergraduate programs or projects to ensure employability skills were captured and addressed throughout the course. These collaborations aim to increase students' understanding of workplace expectations and to create a link between the learning and working environments. A case study presentation of a collaborative approach between industry and an advisory board was the development of a new accounting undergraduate program (Brimble et al., 2012). Over time, the program evolved to include 64 industry partners who offered two-year internships and active engagement within an integrated continuous professional development program. Data collected across a four-year period (n=76) reported high industry partner satisfaction with average scores of 4.59/5 on a Likert scale. The success of this program was credited to the collaborative approach taken with industry during the design, which allowed students to develop industry knowledge, professional skills and exposure to industry partners.

Gilbert (2012) developed the Innovation Fastrack Programme (IFP), which was embedded in an undergraduate entrepreneurship program and relied on a high level of engagement from industry partners for its success. Stakeholders reported high satisfaction from students (n=132) with average scores of 4.88/5 across their entrepreneurship and innovation four-year degree. Additionally, 77% of students attributed employment success to the skills and capabilities derived from the program.

More than 96% of students surveyed indicated that employers specifically asked about the IFP during job interviews and almost 77% of students reported that employers hired them due to the skills and capabilities obtained from the programme. While student satisfaction rates were high across the two studies, they did not assess student employment post-graduation (Brimble, 2012; Gilbert, 2012).

Martinez Leon (2019) proposed a framework to make a Lean Six Sigma (LSS) engineering capstone project that replicates professional work conditions, appropriately balances theoretical knowledge and practical experience, provides students with an industry-recognised certification and that promotes synergistic collaborations between academia and industry. The EAG^{2}ER framework (Explore, Agree, recognise Gaps, Get Started, Execute, and Realise and Reward) was implemented over a calendar year with project execution occurring in the academic semester. Students who completed the LSS capstone project had much higher satisfaction rates when compared with students of other capstone projects. 72% of students who completed the LSS capstone strongly agreed that their capstone project helped them better understand how to apply theoretical models or concepts to real-world situations, compared to 32% of students in other capstones (Martinez Leon, 2019).

The fourth initiative implemented a year-long project in collaboration with industry stakeholders across three Australian tertiary institutions (Keogh, Sterling, & Venables, 2007). Success of the initiative was attributed to careful project selection, identifying supportive clients, clear project aims, 'signposts' to identify possible problems that may arise in the workplace and guides to address problems when they occur. 'Signposts' consisted of a support system that provided students with guidance, security, and confidence during their project. Reported outcomes and student feedback demonstrated that students were able to develop knowledge and skills that led to employment readiness. Furthermore, an industry partner acted as professional referees for students while another project resulted in graduate employment for some students. Ongoing industry projects with new student cohorts have yielded similar student feedback to indicate that the experience enhanced project management skills and knowledge (Keogh, Sterling & Venables, 2007).

Practice-based eLearning

A university-wide eLearning tool was introduced to undergraduate programs across a range of disciplines that mimicked realistic industry-based scenarios (Blackburn, 2017). Designed using eSimulation software, this eLearning tool aimed to develop higher-order thinking, critical thinking and problem-solving skills. One example included a series of clinical cases within a virtual veterinary hospital where students were assessed on their chosen diagnostic pathway during final examinations. Aside from developing key graduate attributes, the tool encouraged domain-specific knowledge development. While employment status was not measured as an outcome of this initiative, feedback from teaching staff and students was presented. Of 240 undergraduate students surveyed across 12 different programs, 72% found that the eLearning tool scenario presented was realistic and reflected cases they would encounter in future employment. However, some students reported eLearning experiences were still not as realistic as being in the workplace. Overall, 77% of students strongly agreed or agreed that the tool helped them to develop a greater understanding of key concepts that promoted problem-solving strategies. Qualitative feedback also suggested that most students were enthusiastic about the task and found it to be beneficial and engaging. Challenges identified by students included the added complexity from the computer-based tool on learning and course materials, and a lack of adequate instruction and feedback.

Mentoring programs

The efficacy of an 18-week mentorship program, where fourth year physical education students mentored second year students from the same degree to develop graduate attributes such as problem-solving skills, feedback and reporting skills was reported (Jenkinson & Benson, 2016). Employment post-graduation was not directly assessed, however, qualitative feedback found that mentors valued the opportunity to work with others as it offered greater benefits in understanding and adapting communication styles to different people.

Building graduate attributes

Another approach to WIL focused on building employment-orientated graduate attributes across a three-year chemistry degree (Windsor et al., 2014). Key attributes deemed important for graduate employability were communication skills and creative and critical thinking. Graduate attributes were embedded into course curriculum with the aim to master these by the end of the degree. All comparative measures showed an increase in student perceptions of knowledge and skills from first to third year. However, the measure was based on a single oral assessment in each year with a small sample of 55 students. Such skills are also expected to naturally evolve over a three-year course and results prior to the implemented changes were not recorded. Furthermore, employment status was also not assessed as an outcome of employability in this study.

Discussion

The aim of this scoping review was to identify trialled and evaluated employability initiatives in undergraduate programs, to assess the feasibility and effectiveness of such initiatives and their potential application to undergraduate nutrition programs. Although the goals of all included studies in this review were of graduate employability, the aims of individual initiatives varied with some targeting the upskilling of personal attributes applicable to the workforce, while others built upon discipline-specific knowledge and skills required for a particular industry or developing a link between learning and workplace environments (Gilbert, 2012).

Findings from this review highlight that the most common employability initiatives were placements, with seven out of 14 studies describing these strategies. These studies also had the longest date range of publications (2010-2019) and included student cohorts ranging from 15 to 865. The employability initiative with the strongest evidence of satisfaction, either as a positive rating or scale by staff, students and/or industry, was project-based industry collaborations. Brimble et al. reported an employer satisfaction score of 4.59/5 from their initiative (Brimble et al., 2012) and Gilbert reported student satisfaction scores of 4.88/5 in their 'Innovation Fastrack Programme' (Gilbert, 2012).

Project-based industry collaborations and placements provide immense value for students through exposure to real-world scenarios, experiential learning and opportunity for professional network development. Students build confidence to navigate the workplace environment and develop skills such as managing their own time and a supervisor relationship. However, industry collaborations and placements are labour intensive from an administrative perspective. They rely on ongoing relationship development, management and effective communication to manage stakeholder expectations to ensure the continuity and success of the partnership (Whatley, 2012). Additionally, managing workplace relationships and feeling performance pressure from the assessable component of a placement can be limiting factors to a student's feelings of preparedness to enter their profession (Aprile & Knight, 2019).

When viewed in the context of nutrition undergraduate programs, it is important to find industry placements that are appropriate for graduate level nutrition students that address both professional competencies as well as graduate and employability attributes. Given the diversity of jobs within the nutrition field, this may be challenging and limit the impact of a placement program on achieving an employability outcome. This diversity is recognised through the newly defined five core competencies for undergraduate nutrition degrees along with a further three specialist competencies in food science, public health and animal nutrition (Lawlis et al., 2019). Furthermore, with the popularity of nutrition-related courses, it may not be feasible to ensure that all graduates will be exposed to programs that include an industry collaboration or placement. The administrative burden of cultivating industry relationships that adequately represent student interest, is a potential barrier to offering thoroughly diverse placements to all graduate level nutrition students.

The respective categories of practice-based eLearning, mentoring programs and building graduate attributes were represented in individual studies and produced valuable insights with the potential for scalability. It was demonstrated that a practice-based eLearning tool can be designed to provide a realistic scenario, as rated by 72% of students (Blackburn, 2017). An effective peer-to-peer, student-run, mentoring elective was shown to assist students to develop graduate attributes (Jenkinson & Benson, 2016). Building graduate attributes through an integrated curriculum in a three-year degree was also demonstrated to be an effective model (Windsor et al., 2014). These findings are important when considering feasibility in large cohorts, in courses with fluctuating student numbers, or in regional or online courses and may have advantages when considering inclusiveness and equal opportunity. Such theoretical approaches allow for the incorporation of domain-specific training, which would meet the evolving needs of the nutrition industry as a multitude of scenarios could be developed to reflect the variety of nutrition-related jobs that currently exist. Furthermore, having the flexibility to build different industry-based scenarios provides opportunity to adapt to an ever-changing industry landscape. However, a limitation in these theoretical frameworks is the lack of opportunity for practical application and authentic learning within real-world settings that a project-based industry collaboration or placement offers.

Overall, most initiatives attributed the success of their approaches to (a) incorporating the development of diverse real-world, problem-solving skills, (b) delivering programs with realistic experiences or settings and, (c) characterising and balancing the most appropriate support with independent self-directed learning. Other methodological considerations reported when developing an initiative include a) the use of a published framework b) consulting stakeholders c) conducting a quality assessment and d) the development of cooperative models between universities, students and industry.

Strengths and limitations

A strength of this scoping review is the methodological approach and inclusion of a quality assessment. However, as only initiatives that have been published were included, there may be other innovative models that have not been captured. A further limitation lies in including programs from different curriculums (Brimble et al., 2012) or that were implemented university-wide (Blackburn, 2017). These programs may lack transferability to undergraduate human nutrition courses, given the differences between and within undergraduate disciplines.

Measurements of employment outcomes varied widely in the studies analysed and depended on the goals of each initiative. Most explored student satisfaction, confidence and transferable graduate attributes such as communication and problem-solving skills and workplace professionalism and preparedness. Graduate employment as an outcome was only measured in three studies that incorporated practical workplace experience through industry collaboration or placement (Jackson & Collings, 2018; Gilbert, 2012; Keogh, Sterling, & Venables, 2007). From these, only one compared

graduate employment outcomes in student cohorts who have completed WIL activities against those who have not (Jackson & Collings, 2018). Therefore, while project-based industry collaboration and placements were the most commonly reported initiatives, the overall evidence of success, measured by graduate employment, was limited. Collecting data on employment outcomes of student cohorts is challenging and requires faculty investment, which may contribute to the low numbers of studies that report such outcomes. As such, there is a bias toward publication of other outcomes that are easily collected such as overall satisfaction.

Implications for research and practice

With undergraduate nutrition programs being widely available in Australia with at least 52 programs available (International Education Specialists, 2020), education designers must become more creative to ensure high student satisfaction as well as graduate capability achievements. Tangible and authentic work scenarios embedded into programs appear to provide the best opportunities for increasing graduate employment. From the sparse yet varied literature in this review, it is evident that further sharing of such practice is important.

Based on the current review, it can be recommended for undergraduate nutrition programs to collaborate with industry partners to provide student placements. Placement offerings should be representative of the diversity of pathways in nutrition and may be developed as a component of a broader agreement between tertiary institutions and industry where the needs of both parties are met. Value can be added to the partnership through building a foundational framework for student contribution to larger industry projects and goals.

While industry placements will vary, preparation for employment can be developed universally through development of transferable graduate attributes. Students are now expected to graduate with a range of transferable skills to be successful in the workforce. A range of identified graduate skills and attributes have been deemed necessary by employers (Selvadurai, Er, & Maros, 2012): planning and problem-solving skills; research skills including locating and manipulating information; public speaking and communication skills; social interaction skills across all levels of an organisation; self-confidence; commitment and passion; and entrepreneurial skills (Kucel, Robert, Buil, & Masferrer, 2016).

Several models identified from this review may be useful for development of graduate skills. The use of eLearning simulations for industry-specific preparation, provides opportunity for a broad and objective reach across the student cohort. It is important that skill development is embedded at critical points within the curriculum and not as isolated additional learning. Greater success is seen when students value and engage in skill-development rather than as a burden (Jackson & Collings, 2018). While peer mentoring holds advantages for senior and junior students, formal mentoring and situational mentoring could be explored.

In summary, future undergraduate nutrition programs with a focus on graduate employment could consider the following:

1. University-based curriculum with embedded transferable skills development that uses eLearning or mentoring for delivery of key 'soft' skills learning in addition to or in place of more conventional methods.
2. Industry-based placements where both industry and transferable skills are further developed through project-based placements or student projects that sit within a broader industry project.

As more literature becomes available, these considerations should be adapted to reflect new understandings towards successful nutrition graduate employment.

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Appendix

Table 1: Characteristics of Employability Initiatives

Author	Location	Student population and discipline	Sample Size	Duration of study	Study design type	Curriculum Initiative	Research Objectives	Main Outcome Measures
Aprile & Knight, 2019	Australia	3rd & 4th year teacher education students from one regional Australian University	15	One time point	Case Study	Well-established initial teacher education placements	The study investigated the students' placement experiences and the impact of these experiences on their perceptions of readiness for a career in the teaching professions.	Thematic analysis is the method used to identify two key themes in the data collected through semi-structured interviews.
Blackburn, 2017	Germany	Undergraduate; University wide	12 teaching staff and 240 students	One time point	Exploratory case study	Practice based E-Learning :an interactive eLearning tool based on Problem Based Learning (PBL) and acquisition of domain-specific knowledge	1. How to create or utilise existing materials that are aligned with the goals of PBL to establish significant differences in terms of student learning in an eLearning environment? 2. What issues are experienced by educators when adopting technology-based PBL resources in their teaching? 3. What are students' perceptions of such eLearning courseware? 4. How can technology be used to stimulate higher level thinking skills?	Number of students who thought that scenarios (cases) used in the PBL tool to a certain degree represented real-life issues that graduates were likely to encounter. Number of students who thought PBL was easy to comprehend Number of students who agreed it was beneficial to incorporate graphics components into the learning materials Number of students that believed using the PBL software had helped their understanding of key concepts and scenarios promoted a logical though process rather than straight forward factual recall Student perspectives on use of PBL tool Faculty staff perspectives on use of PBL tool
Brimble et al. 2012	Australia	Undergraduate; Accounting and financial planning	190 students 76 industry participants 68 end of year surveys	3 years	Case study via evaluation and surveys	Project based industry collaboration: Design of a new Professional Degree that includes a 2-year internship and a continuous professional development program, created in collaboration with industry	Work closely with industry to deliver a program that addressed their concerns about the work readiness and generic skills of graduates, and engaged students to enable them to make informed choices about their vocation.	Determine the impact of the Degree and the PD Program in terms of: - Industry engagement - Overall satisfaction of industry - Integrating the University with the profession - Development of Students' professional skills and impressions
Cord & Clements, 2010	Australia	Undergraduate; Commerce	28 students	One time point	Case study via reflections and semi-structured interviews	Placement: The Commerce Internship Program (CIP) is a 16-day placement conducted during session. The placement description is based on the needs of the host organisation, as is the selection of the student. One semester before the placement, host organisations submit a description of the role while students apply for the program through an online application system directly to the faculty. The faculty shortlists applications and the host organisation is invited to interview three students. The placement can take place anytime over the following semester.	Explore students' self-reported learning outcomes and development through reflection at the completion of the CIP.	N/A

Author	Location	Student population and discipline	Sample Size	Duration of study	Study design type	Curriculum Initiative	Research Objectives	Main Outcome Measures
Elijido-Ten & Kloot, 2014	Australia (Melbourne)	Undergraduate; Accounting	12 employer representatives 35 students (30% response rate)	One time point	Exploratory case study via interview and survey	Placement: Evaluation of Work-Integrated Learning	1. How are accounting WIL programs perceived by both SME and non-SME employers? 2. How do WIL programs enhance students' experiential learning and are there difference in the role played by SMEs and non-SMEs in providing WIL experience as perceived by accounting students? 3. How can university WIL programs be enhanced to achieve better outcomes for both students and employers alike?	Employers' perception of WIL and their role in learning WIL Advantages and Disadvantages to Employers and Students Students' perception of experiential learning from WIL placement Students' experiential learning through WIL Suggestions for WIL improvement Students overall WIL experience and suggestions for improvement
Fleming & Haigh, 2017	New Zealand (Auckland)	Undergraduate; Sport education	Questionnaires: 91 students 18 academic supervisors 28 workplace supervisors Interviews: 6 students 5 academic supervisors 5 workplace supervisors	One time point	Exploratory case study via questionnaires and interviews	Placement: A Sport Cooperative Education Program that involves students completing 350 hours of workplace experience in a sport or recreation organization during the final year of their undergraduate degree. The experience was generally unpaid and part-time (normally two days per week), allowing for academic studies to be completed on campus during the rest of the week. In most cases, students secured their own placements in response to advertisements and contacts provided by the university, or through their own personal contacts. Students negotiate appropriate work activities with a workplace supervisor and developed a learning agreement that included the responsibilities of students, host organizations, supervisors and the university as well as the students' individual learning outcomes. The student learning experience was supported through regular fortnightly meetings with an academic supervisor during their on-campus time.	Examine the degree of alignment of stakeholder views on the defining features of cooperative education as a model of Work Integrated Learning	Students', industry supervisors' and academic supervisors' views on "the purpose of cooperative education". Students', industry supervisors' and academic supervisors' perspectives on "what cooperative education means".
Fletcher-Brown, Knibbs & Middleton	United Kingdom (Portsmouth)	Undergraduate; Marketing	85 students/ "engagers" 5 employers 5 educators	One time point	Case study	Placement: Live-client learning activities are activities where students are directed by an organisation to work on a current or potential business problem or project either as individuals or groups. The responsibility associated with meeting the needs of an existing organisation and the potential of contributing value often increases student motivation, enjoyment and engagement.	Review live-client learning activities in higher education	Explore the value of live-client projects as both an alternative to traditional placements and an opportunity for students to provide higher level, strategic input to SMEs in particular

Author	Location	Student population and discipline	Sample Size	Duration of study	Study design type	Curriculum Initiative	Research Objectives	Main Outcome Measures
Gilbert, 2012	Australia (Melbourne)	Undergraduate; Entrepreneurship	132 students	Four years	Longitudinal quantitative and qualitative	Project- based Industry Collaboration: The Innovative Fast Track Program - program design was not included. It was designed specifically to overcome: differing stakeholder perspectives and evolving expectations, variability in student experience, and level of industry partner engagement.	1. How can higher education entrepreneurship programmes foster opportunity recognition and realisation capabilities in largely inexperienced undergraduates? 2. What are the key determinants that may contribute to developing entrepreneurial and innovative work-ready skills in undergraduate entrepreneurship students?	Did the IFP meet participate expectations? The Good Teaching Scale Employability Create-Substantiate-Activate (CSA) Scale
Jackson & Collings, 2018	Australia	Bachelor graduates; A range of disciplines	865 total students Sample 1 n=628 Sample 2 n=237	Sample 1 = 16 months Sample 2 = 4 months	Double cohort study	Placement: Work-Integrated Learning defined as a work placement whereby students are physically based in the workplace for a given period, combined with reflective activities which integrate their learning in the professional and classroom settings	1. Examine the influence of WIL on graduate employment and underemployment 2. Examine the influence of paid employment during studies on graduate employment and underemployment 3. Explore graduate perspectives of inhibitors and enablers to employability and employment	Full-time Employment Underemployment Inhibitors and enablers of employability and employment
Jenkinson & Benson, 2016	Australia (Melbourne)	Final year; Physical education	25 pre-service teacher mentors	2 years (2014-2016)	Focus groups	Mentoring: The Assessment and Mentoring Program (AMP) is a four-way collaborative mentoring learning community underpinned by social constructivism. It promotes the development of assessment and mentoring skills which are readily transferable to future teaching environments. The mentors are Year 4 pre-service physical education students mentoring and assessing Year 2 pre-service physical education students. The purpose of the program is to provide additional authentic opportunities within the degree to learn how to design and then actually implement assessment tasks, and complete assessment as a formative process. The AMP runs for 18 weeks including training (3 days), preparation, and assessment and mentoring within the semester (12 weeks) and concluding focus groups for reflection.	Describe an attempt to design higher education curriculum using mentoring to further improve graduate outcomes and work readiness.	What skills did AMP mentors perceive they would develop through participation in the program to assist with their future teaching career? Do the skills they perceive they will develop align with the AITSL Graduate Standards?
Keogh, Sterling & Venables, 2007	Australia	Undergraduate; Computing			Case Study (of 3 sites)	Project Based-Industry Collaboration: Year-long team projects with external clients provide a well-recognized opportunity for students to gain industry experience, whilst being supported and guided by staff to minimize risks.	Propose a structure for year-long projects that is scalable to any class size and portable across institutions and potentially across technical disciplines.	N/A

Author	Location	Student population and discipline	Sample Size	Duration of study	Study design type	Curriculum Initiative	Research Objectives	Main Outcome Measures
Rawlinson & Dewhurst, 2013	United Kingdom (Buxton)	University students in vocational courses	N/A	N/A	Qualitative Case Study	Placement: The University Learning Laboratory is founded on the concept of Real World Learning (RWL) and is an example of work-integrated learning. A university learning laboratory allows local organisations to become a "real world learning" venue for applied vocational learning supported by staff from the organisation in on-the-job training. A learning laboratory also presents the opportunity for students to engage in live project work that can support an organisation in delivery its strategic and operational goals.	Describe the University Learning Laboratory model used at the University of Derby	N/A
Martinez Leon, 2019	United States	Engineering and management design course students	Not identified	One time point	Case Study	The core of this approach is the problem-based learning through the execution of Lean Six Sigma (LSS) projects implemented via university-industry partnerships.	The case study presented offers a detailed analysis of the design and implementation of the proposed framework. The authors also present the results of a survey conducted to assess the extent to which the proposed approach contributes to bridging the gap between theory and practice.	Results from pilot implementation & student survey results
Windsor et al., 2014	Australia	Undergraduate; Chemistry Major in a Bachelor of Science	1st yr students - 65 pre - 73 post 2nd yr students - 12 pre - 10 post 3rd yr students - 8 presentations - 11	One year	Intervention Study Design	Graduate Attribute Framework: The 12 graduate attributes that the University expects students to attain, are incorporated into a new Chemistry major using three methods; they are taught in lectures; practiced in tutorials; and assessed in examinations, practical reports and oral presentations and feedback provided after each assessment piece.	Ascertain students' perceptions of their acquisition of graduate attributes through surveys and compare with student performance on assessment tasks.	First year students' perceived theoretical chemistry knowledge First year students' perceived practical chemistry knowledge Second year students' conceptions of their skill sets before and after studying the course Staff assessment of second year student performance at the oral debate Changes between the initial and final oral presentation percentage score in the third year course Third year students' perceptions on their ability to solve physical chemistry problems

Table 2: Critical Appraisal of Study Quality using the CASP Qualitative Appraisal Tool

	Aprile & Knight (2019)	Blackburn (2017)	Brimble et al (2012)	Cord & Clements (2010)	Elijido-Ten & Kloot (2014)	Fleming & Haigh (2017)	Fletcher-Brown, Knibbs & Middleton (2015)	Gilbert (2012)	Jackson & Collings (2018)	Jenkinson & Benson (2016)	Keogh, Sterling & Venables (2007)	Martinez (2019)	Rawlinson & Dewhurst (2013)	Richardson & Marshall (2019)	Windsor et al. (2014)
Q1. Was there a clear statement of the aims of the research?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓
Q2. Is a qualitative methodology appropriate?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	?	✓
Q.3 Was the research design appropriate to address the aims of the research?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	?	✓
Q4. Was the recruitment strategy appropriate to the aims of the research?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	?	✓
Q5. Was the data collected in a way that addressed the research issue?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓
Q6. Has the relationship between the researcher and participants been adequately considered?	✓	?	?	?	?	?	?	?	✓	✓	✓	?	✓	?	✓
Q7. Have ethical issues been taken into consideration?	✓	✓	?	?	✓	✓	?	?	?	?	?	?	?	?	✓

Q8. Was the data analysis sufficiently rigorous?	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	?	✔
Q9. Is there a clear statement of findings?	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	X	✔
Q10. How Valuable is the research?	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	X	✔

✔ = yes; ? = can't tell; X = no