IJSHE
26,9

112

Received 12 July 2024
Revised 24 October 2024
30 January 2025
Accepted 6 February 2025

Responding to urgent calls for fit-for-purpose planetary health curricula: an examination of nutrition and dietetics tertiary education

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Abstract

Purpose – Health professionals play a crucial role in addressing the climate crisis and contributing to sustainable development. However, despite urgent calls from experts and health professions students, tertiary education currently lacks fit-for-purpose planetary health curricula. This study aims to provide a comprehensive, Australia-wide examination of planetary health curricula offered within two health professions: nutrition and dietetics.

Design/methodology/approach – This mixed-method study involved two phases. Firstly, content analysis of publicly available unit titles and descriptions to determine the frequency and distribution of relevant curricula. Secondly, content and inductive thematic analysis of relevant learning outcomes, guided by Bloom's Revised Taxonomy to assess the level of cognitive learning and the subject matter being prioritised.

Findings – Examination of 104 degrees offered by 41 Australian universities identified relevant curricula in 71 nutrition degrees (84%) and 18 dietetics degrees (95%). Majority of relevant learning outcomes (n = 137) focus on lower-order cognitive learning, with 11 themes of subject matter identified; planetary health, critiquing the status quo, innovation and disruption, equity, values-based practice and evidence-based practice, (dietary modification, food service in health-care settings, food and nutrition policy, food system drivers and elements of the food supply chain.

The authors would like to acknowledge Charlotte Barber from the Monash Centre for Scholarship in Health Education for her contribution to the data analysis.

Declaration of interest: The authors report there are no competing interests to declare. The authors alone are responsible for the content and writing of the article.

Funding: The authors report there is no funding associated with the work featured in this article.

International Journal of Sustainability in Higher Education
Vol. 26 No. 9, 2025
pp. 112-130
Emerald Publishing Limited
1467-6370
DOI 10.1108/IJSHE-07-2024-0465

Originality/value – This study identified an increase in coverage of planetary health curricula in Australian nutrition and dietetics degrees compared to previous examinations and the need for higher-order learning to adequately equip the future health workforce.

Keywords Health professions, Climate action, Sustainable development, Planetary health

Paper type Research paper

Introduction

Our ability to safeguard human health in the face of irreversible degradation of our natural life support system is one of the greatest challenges of the 21st century (Whitmee *et al.*, 2015). Alarmingly, the situation is worsening with six of nine planetary boundaries now transgressed, meaning that civilisation as we know it has pushed our Earth's natural systems beyond their safe operating zone (Richardson *et al.*, 2023). We have entered what is termed the triple planetary crisis, where three major and interconnected crises of climate change, pollution and biodiversity loss co-exist, and leading experts are calling for transdisciplinary, collective action (United Nations Climate Change, 2022). Planetary health is a "solutions-oriented, transdisciplinary field and social movement focused on analysing and addressing the impacts of human disruptions to Earth's natural systems on human health and all life on Earth" (Planetary Health Alliance, 2021). To prepare current and future generations to address these challenges, higher education must play a critical role. There are urgent calls to action for transdisciplinary, multi-sector and systemic transformation in higher education (Howard *et al.*, 2023). However, resounding evidence from the health sector suggests this is not happening quickly enough with educators ill-equipped to facilitate planetary health education (Brand *et al.*, 2021) and graduates ill-prepared to practice in a rapidly changing world (Romanello *et al.*, 2022). Understanding where current education practice is at within the tertiary sector is critical to inform future efforts that respond to these urgent calls for transformative action.

Focus in existing literature tends to be theoretical in nature, offering "how to" frameworks and guides to inform best-practice planetary health education. A multitude of approaches exist to encourage urgent and widespread curricula integration. Examples of top-down approaches include the Academic Health Institutions' Declaration on Planetary Health (Howard *et al.*, 2023) and the United Nations University Guide for Sustainable Development education (Sustainable Development Solutions Network, 2020), whilst the Planetary Health Report Card (2023) approach offers a student-led approach being implemented in multiple health professions and country contexts. The literature also offers guidance regarding "how to" implement planetary health education by way of best-practice frameworks (MacKenzie-Shalders *et al.*, 2023; Guzmán *et al.*, 2021; Lokmic-Tomkins *et al.*, 2024), practical advice for educators (Schwerdtle *et al.*, 2020) and guidance for national and global accreditation standards in AMEE's Consensus Statement (Shaw *et al.*, 2021). To date, only a small number of studies have evaluated the current state of play of planetary health curricula coverage within and across health professions programmes. Studies published in the past five years revealed that 57% of medical degrees in the UK had sessions on planetary health (Bevan *et al.*, 2023) and 50% of degrees within 90 nationally accredited schools of public health offered education about climate change and health (Arora *et al.*, 2023). There is also a paucity of follow-up or longitudinal studies to determine how planetary health curriculum coverage is changing and evolving over time. With urgent calls for bold transformative action, increasing attention must be placed on understanding what is happening in existing tertiary education, where the gaps exist (and why they do) and what evidence-based, systemic actions are required to address these gaps.

One system that requires urgent attention is the global food system, defined as "the interconnected system of everything and everybody that influences, and is influenced by, the activities involved in bringing food from farm to fork" (Hawkes, 2019). The food system is undermining the health of current and future generations by contributing one-third of global greenhouse gas emissions, causing malnutrition in all its forms and driving social inequalities (Fanzo and Davis, 2021; Schneider *et al.*, 2023; Crippa *et al.*, 2021; Marrero *et al.*, 2024). Nutritionists and dietitians work within this food system in a number of settings and with many key stakeholders and are therefore well-positioned to contribute to transformative action (Spiker *et al.*, 2020). However, to ensure they adequately prepared to do so, nutritionists and dietitians must be exposed to sustainable food systems education and planetary health education during their tertiary training. Despite recognition that this is urgently required, competency requirements and curricular integration remain inconsistent globally (Browne *et al.*, 2024; Wegener *et al.*, 2024). A review of accredited nutrition and dietetics programmes (n = 351) in the UK, Australia and Canada identified only 12 courses/units that focussed on sustainable food systems education (Wegener *et al.*, 2024). Specific to Australia, in 2016, the authors of this present study did an audit of nutrition and dietetics programmes and identified that only 8% offered sustainable food systems education (Carino *et al.*, 2020).

Anecdotal evidence suggests that educators are integrating more sustainable food systems education and planetary health education into their practice as they gain capacity within this emerging field of nutrition and dietetics programmes. However, a detailed examination of this changing tertiary landscape is yet to be documented. This study fills this research gap by presenting a comprehensive examination of higher education practice in Australia for nutrition and dietetics. A multi-phase approach was used to answer two research questions: To what extent do nutrition and dietetics degrees in Australia offer planetary health curricula? and What relevant learning outcomes exist, what level of cognitive learning do they aim to achieve and what subject matter is prioritised?

Methods

Study setting, context and researcher reflexivity

This study examines the higher education landscape for both nutrition and dietetics professions in Australia. Terminology in the field of nutrition and dietetics differs internationally. In the Australian context, a nutritionist provides advice on matters relating to food and how it impacts health, working within a range of roles such as public health, research, food industry, food technology and communication. In Australia, dietitians work in similar roles to nutritionists with the addition of hospital and other clinical settings, where they provide advice on medical nutrition therapy (NSA, 2024). This study examined curricula in both professions as both nutritionists and dietitians work within the food system and have capacity to promote planetary health outcomes in a variety of settings and areas of practice (Barbour *et al.*, 2022).

This study draws upon both quantitative and qualitative methods. The qualitative analysis, in particular, draws upon the authors' personal experiences and expertise. Both authors are Accredited Practising Dietitians and educators in the Department of Nutrition, Dietetics and Food at Monash University in Australia. Together, they developed Australia's first compulsory unit on food sustainability systems for nutrition students in 2015 and have continued to innovate and facilitate this curriculum. Both authors recognise the value of concept-based curricula (Tweedie *et al.*, 2021) for teaching the nuance of planetary health and advancing nutrition and dietetics education beyond "facts to be known". Both authors have over 20 years of practical experience working to improve the food system across

various settings, including the charitable food sector, local government, community health services and academia in Australia and the Pacific. At all stages of the research process, from determining research questions to data analysis, both authors drew upon their positionalities as dietitians and expertise in sustainable food systems education. Both authors acknowledge that shared values of social justice, sustainable development and global perspectives influenced their interpretation of data and the final results.

Study design

This study involved two phases to answer the research questions. Phase one identified eligible degrees for nutrition and dietetics students in Australia offering planetary health curricula, and phase two examined the relevant learning outcomes from these degrees (see Figure 1).

Phase one: identifying relevant curricula

As terminology regarding the tertiary education sector differs internationally, it is important to clarify the language used in this study. A degree refers to the overarching training programme, ranging from one to five years in duration for a full-time student. A unit refers to the modules or subjects that students enrol in to complete their degree, usually approximately three to four months in duration for a full-time student. And a learning outcome is a statement that describes the intended impact on student learning, in terms of what the learner knows or can do as a result of learning, upon completion of a degree or unit (Allan, 1996). To identify relevant curricula, this study first identified relevant degrees, then relevant units within those degrees and finally relevant learning outcomes within these units.

Identifying eligible degrees. To comprehensively examine Australia's tertiary landscape, all available nutrition and dietetics degrees were first identified, then screened for relevant curricula between January and April in 2023. The Web pages of all 39 Australian universities listed on the Universities Australia website (Universities Australia, 2024) were screened to identify relevant nutrition degrees depending on key terms and graduate status, specifically the eligibility of graduates to gain "Associate Nutritionist" or "Accredited Practising Dietitian" status (Table 1).

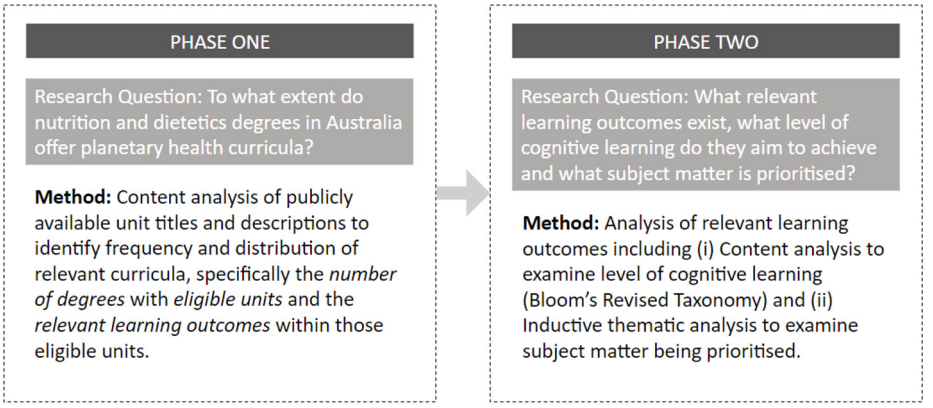

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Figure 1. Study design

Table 1. Inclusion criteria for identifying eligible degrees

Criterion	Nutrition	Dietetics
Key terms	Degrees which included "food", "nutrition" and/or "diet" in their title	
Graduate status	Degrees or a higher education pathway where graduates can apply for Associate Nutritionist status through the Nutrition Society of Australia (NSA)	Degrees where graduates are eligible for Accredited Practising Dietitian (APD) status with Australia's dietetic governing association, Dietitians Australia (DA)

Source: Table created by authors

Regarding graduate status, accreditation processes in Australia differ between the disciplines of nutrition and dietetics; therefore, a different search strategy was required to identify eligible degrees based on graduate status. Two additional Australian universities (Endeavour College and Torrens University) were identified as offering eligible degrees after correspondence with the Nutrition Society of Australia (NSA) and were therefore screened also. For dietetics degrees, eligibility for Accredited Practising Dietitian status requires graduates to complete a degree previously accredited by Dietitians Australia (DA). The 21 accredited degrees offered by 16 universities were listed on the DA website in January 2023 were all eligible for this study (Dietitians Australia, 2024). For both Nutrition and Dietetics, a sub-set of five universities was double-screened by both authors to identify eligible degrees, and this process resulted in zero discrepancies. The screening process for remaining universities was divided between the two authors, who met frequently to discuss any complex decisions specific to the eligibility criteria.

Identifying eligible units. Once eligible degrees were identified and duplicates removed, the units offered within each degree were examined for relevance. This next stage of screening was achieved by visiting the website for each degree and analysing the title, synopsis and learning outcomes for all units offered within each degree. Key terms were identified, based on similar mapping research conducted previously within nutrition and dietetics (Carino *et al.*, 2020; Wegener *et al.*, 2024) and with an intention to refine the scope of this study. A sub-set of ten degrees was initially double-screened by both authors, with several discrepancies discussed to iteratively refine the inclusion criteria and key terms (Table 2). The remaining degrees were then divided amongst the two authors for independent

Table 2. Inclusion criteria for identifying eligible units

Criterion	Inclusion	Exclusion
Degree type	AQF level 7 (bachelor's degree) and above	AQF level 6 and below
Key terms	Environment*, ecolog*, sustainab*, food system, agriculture, climate change, food waste, planetary health	References to these key terms not within the context of nutrition, food systems, environmental sustainability, planetary health and/or climate change
Publicly available information	Access to unit title, synopsis and learning outcomes	

Source: Table created by authors

screening, who again met frequently to discuss any complex decisions and further refine the eligibility criteria.

For units that met inclusion criteria, the following details were retrieved from each website and documented in a Microsoft Excel document for analysis; state, university and degree name; number of units offered; unit title, (iv) unit description, (v) all unit learning outcomes, (vi) details of unit - Australian Qualifications Framework (AQF) level (AQF, 2024), core VS elective, Equivalent Full-Time student Load (EFTSL) (Australian Government Department of Education, 2024) and (vii) contact name and email address for unit administrator.

Information about eligible degrees and units were analysed (frequencies and percentages) to determine the nutrition and dietetics degrees that offered eligible units and the AQF level, whether the unit was core or elective, and the EFTSL of eligible units.

Identifying relevant learning outcomes. To identify the specific learning outcomes within units identified as relevant to planetary health and sustainable food systems, all learning outcomes in the Excel document were screened. Learning outcomes were deemed relevant for this study if they included key terms "environmental" OR "ecolog*" OR "sustainable" OR "food system" OR "agriculture" OR "climate change" OR "food waste" OR "planetary health" OR synonyms of these. The screening of learning outcomes involved three researchers: the two authors of this paper and an additional research assistant. A sub-set of all learning outcomes from 20 eligible units (>10%) were initially double-screened by the research assistant (see Acknowledgements) and one author, and the remaining learning outcomes were primarily screened by the research assistant with regular discussion between all three researchers to resolve any complex decisions. Once relevant learning outcomes were identified, they were collated and imported into NVivo data analysis software for thematic analysis.

Phase two: examining relevant curricula

To answer the second research question, the relevant learning outcomes were analysed to determine the level of cognitive learning they aimed to achieve and the subject matter they focused on.

Examining the level of cognitive learning. The verbs included in relevant learning outcomes were analysed to determine the level of intended cognitive learning, i.e. the desired performance or behaviour for students to be successful in their learning. The verbs were deductively coded in NVivo analysis software according to the six categories of Bloom's Taxonomy, revised by Krathwohl (2002). These revised Bloom's Taxonomy categories are arranged in a hierarchy of cognitive complexity from remembering to understanding, then applying, analysing, evaluating and creating. If learning outcomes included more than one verb (e.g. "Analyse and evaluate strategies…" only the first verb was included in the analysis. A sub-set of verbs from 20 learning outcomes (approximately 10% of learning outcomes) were deductively coded according to the six revised Bloom's Taxonomy categories by the research assistant and the two authors, who subsequently met to discuss and resolve any discrepancies. The remaining learning outcome verbs were deductively coded by the research assistant with regular discussion between all three researchers to resolve any complex decisions. Once all learning outcome verbs were coded, descriptive statistics (frequencies and percentages) were calculated for each of the six revised Bloom's Taxonomy categories.

Examining subject matter. The field of planetary health is broad, as is the breadth of relevant subject matter specific to nutrition and dietetics. This study sought to examine the subject matter being prioritised by educators and included in the relevant learning outcomes. Using the same set of relevant learning outcomes identified previously, these were collated in

a Microsoft Excel spreadsheet for analysis. The Braun and Clarke's (2021) step-wise approach to thematic analysis was implemented, with both authors involved in each step:

- Familiarisation with the data – Both authors were immersed in the data from previous data screening and analysis.
- Coding – All learning outcome subject matter was coded by both authors together, using colour-coded highlighting to create and apply code labels to relevant words and phrases. For example, climate change, food supply and social justice. A shared agreement of definitions for each of the code labels was developed.
- Generating initial themes – A large quantity of code labels was created during the coding process and therefore some initial themes were formed by grouping code labels that share key ideas or concepts. For example, critiquing the current food system and applying an equity and social justice lens.
- Developing and reviewing themes – The authors then returned to the original data set of all relevant learning outcomes to check whether the initial themes reflected patterns in both the code labels and the authors' existing knowledge on food systems. Here, the authors discussed their shared experiences of teaching planetary health curricula in relation to education literature urging for concept-based curriculum (Tweedie *et al.*, 2021), where concepts are more abstract and universal than content-based curriculum that focuses on the facts to be known. Informed by their expertise and collaborative experience teaching planetary health concept-based curricula within the field of nutrition and dietetics, they noticed that many curriculum concepts were relevant to all health professions, whereas some were specific to the fields of nutrition and dietetics. Both authors reviewed the curriculum concepts and jointly grouped them into one of two categories: applicable to all health professions or specific to nutrition and dietetics.
- Refining, defining and naming themes – This step involved both authors reviewing the overarching themes to ensure they captured the breadth of subject matter being prioritised, while also being grouped into concept topics. The authors jointly agreed upon wording to describe each curriculum concept.
- Writing up – The authors agreed that analysis of subject matter would be best presented as a visual presentation of curriculum concepts, in addition to a table describing each concept with an exemplar learning outcome to show it in context.

Results

In total, 104 relevant degrees across 41 Australian universities were screened. In total, 89 Nutrition and/or Dietetics degrees contained 137 unique units that offer nutrition and dietetics students in Australia an opportunity to engage in planetary health curricula (Figure 2). Of note, six eligible units were offered across both a nutrition and dietetics degree within the same institution, meaning that students from two different degrees could take the same eligible unit.

The majority (86%) of nutrition and dietetics degrees in Australia include planetary health curricula (Table 3). A greater proportion of eligible units was identified from Dietetics degrees (95%) than from Nutrition degrees (84%).

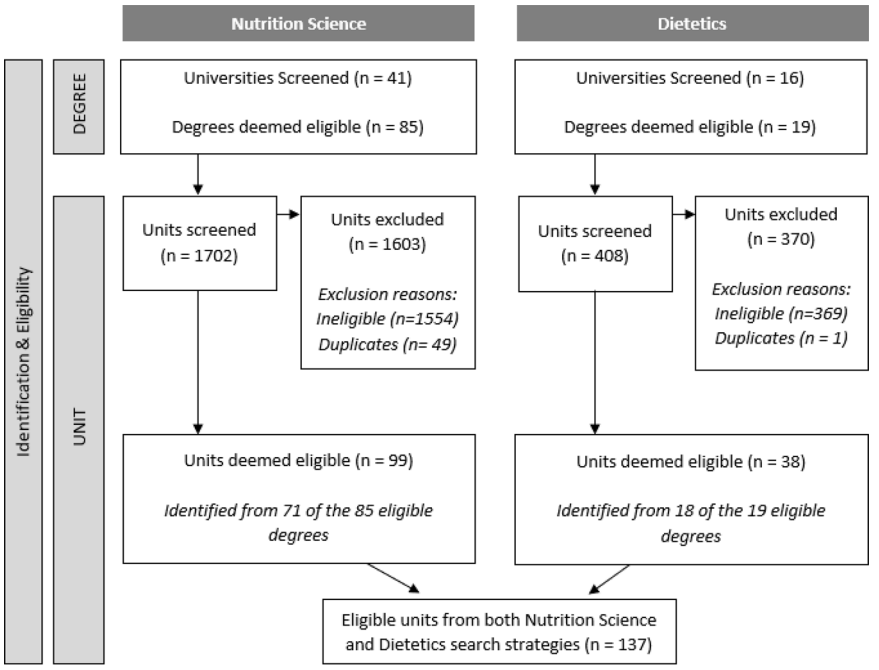

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Figure 2. Flow diagram of degree and unit screening processes

Table 3. Proportion of nutrition and dietetics degrees offering food systems education in Australia

Degree type	Degrees with eligible units%	Degrees without eligible units%
Nutrition degrees *n* = 85	71 (84)	14 (16)
Dietetics degrees *n* = 19	18 (95)	1 (5)
Total degrees *n* = 104	89 (86)	15 (14)

Source: Table created by authors

Analysis of units

Whilst 137 units met inclusion criteria, this represents 6.5% of the total units screened across Nutrition and Dietetics degrees (n = 2,110) that include planetary health curricula. Of the 137 units that met inclusion criteria across both Nutrition and Dietetics degrees, more units were within bachelor's (AQF7) compared with master's (AQF9) level degrees (Table 4). Dietetics degrees tended to have more eligible units at master's level compared with Nutrition degrees, where a greater proportion of eligible units were at bachelor's level. Across both degree categories, the majority of eligible units were a core, rather than an elective requirement and were weighted 0.125 EFTSL.

Table 4. Characteristics of 137 units that met inclusion criteria

Characteristic	Nutrition units *n* = 99 *n* (%)	Dietetics units *n* = 38 *n* (%)	Total units *n* = 137 *n* = (%)
Unit offered within:			
Bachelor (AQF7)	58 (59)	16 (42)	71 (52)
Grad Cert/Grad Dip (AQF8)	7 (7)	–	10 (7)
Master (AQF9)	30 (30)	22 (58)	52 (38)
N/A	4 (4)	–	4 (3)
Completion requirement:			
Core	71 (72)	37 (97)	108 (78)
Elective	23 (23)	1 (3)	24 (18)
N/A	5 (5)	–	5 (4)
Weighting of unit in degree (EFTSL):			
0.125	89 (90)	31 (82)	122 (89)
0.250	5 (5)	7 (18)	10 (7)
1.0	1 (1)	–	1 (1)
N/A	4 (4)	–	4 (3)

Source: Table created by authors

Analysis of learning outcomes

Within the 137 units that met inclusion criteria, 201 unique learning outcomes that specifically addressed planetary health were identified. The analysis of verbs used in each learning outcome revealed that they were most frequently classified within the lower-order "Understanding" category, as presented in Figure 3. When the AQF level of the respective course was overlaid, there appeared to be a trend where the majority of lower-order "Remembering" and "Understanding" learning outcomes sat at AQF Level 7 (bachelor's degree). For the higher-order domains (Analysing, Evaluating and Creating), the spread between undergraduate and postgraduate education appeared to be even (Figure 3).

The subject matter described in these 201 relevant learning outcomes was thematically analysed by both authors to reveal 11 themes or "concept-based curriculum topics" (Figure 4). Of these, six curriculum concepts were identified as applicable to all health professions while five curriculum concepts were deemed specifically relevant to nutrition and/or dietetics professions.

The 11 curriculum concepts, their descriptions and an example learning outcome is detailed in Table 5, with further information provided in the Supplementary Material (*Curriculum concepts with example topics coded to each theme and example learning outcomes*). By way of example, the curriculum concept of "Planetary Health" includes topics of "climate change, global to local, Social Determinants of Health, four dimensions of sustainability (social, economic, cultural and environmental) and socio-ecological approach to health". An example learning outcome within this curriculum concept was "Examine current food and nutrition issues and relationships with human health, societal concerns, stakeholder influences and the finite nature of the food supply". Curriculum concepts specific to nutrition and dietetics were most commonly encountered, particularly the phases of the "Food Supply Chain" and relationships between planetary health outcomes and "Food Service in Health-care Settings". Curriculum concepts applicable to all health professions were less common, particularly "Critiquing the Status Quo" and "Innovation and Disruption".

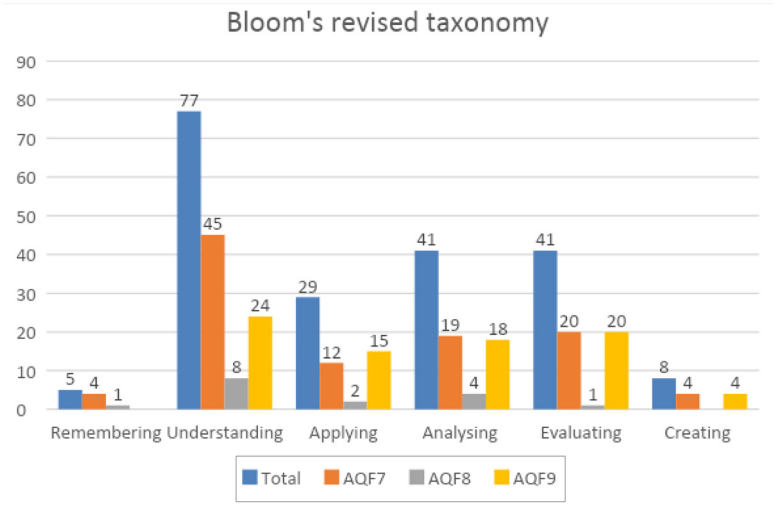

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Figure 3. Analysis of relevant learning outcomes (n = 201), according to Bloom's revised taxonomy

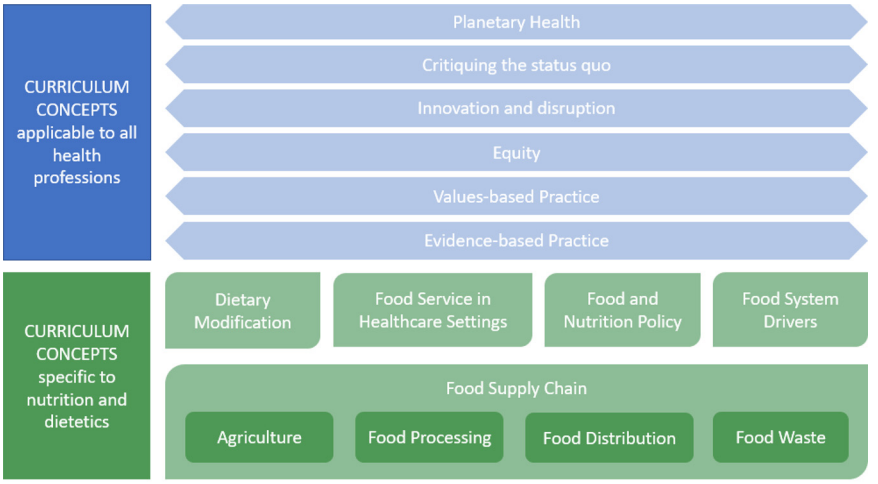

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Figure 4. Curriculum concepts, as described in relevant learning outcomes of eligible units

Discussion

This study sought to examine the inclusion of planetary health curricula in nutrition and dietetics degrees in Australia. This study revealed that 86% of nutrition and dietetics degrees offered in Australia currently include planetary health curricula, with the relevant content provided in 137 unique units of which 78% are compulsory. A similar audit revealed that

Table 5. Curriculum concepts with example learning outcomes

Curriculum concepts and description	Example learning outcome
Planetary health Examining the relationship between human health and the natural ecosystems upon which it depends	Examine current food and nutrition issues and relationships with human health, societal concerns, stakeholder influences and the finite nature of the food supply
Critiquing the status quo Investigating the current food system through a critical lens to identify undesirable impacts	Investigate and critically discuss the Australian food system including the global and local factors affecting our food supply
Innovation and disruption Exploring opportunities to deviate from the status quo using innovative and entrepreneurial thinking	Examine and compare the properties and applications of novel and emerging food ingredients, including recent innovations in the production of Australian native foods
Equity Applying a social justice lens to identify challenges and opportunities to create a more equitable food system	Investigate public health priorities from a holistic, ecological, salutogenic and social justice perspective
Values-based practice Applying diverse lenses to examine sustainable food systems and planetary health issues	Investigate first nations people's perspectives on the impact of environmental issues on health and well-being
Evidence-based practice Incorporating diverse sources of evidence to inform the way in which practice to promote planetary health outcomes is conducted	Demonstrate an understanding of the key frameworks, concepts, arguments and debates in the literature relating to sustainable food systems
Dietary modification Applying specialised dietary knowledge to examine the impact of dietary intake on food systems and vice versa	Evaluate and discuss the relationships between the nutritional requirements of consumers and the sustainable production of high-quality protein
Food service in health-care settings Examining the interconnected relationships between food service systems and planetary health outcomes	Demonstrate a sound knowledge and application of food systems and management in a health-care setting, including menu planning, recipe standardisation, quality, sustainability, food safety and organisational and business skills

(*continued*)

Table 5. Continued

Curriculum concepts and description	Example learning outcome
Food and nutrition policy Exploring public health interventions to promote planetary health outcomes	Identify key food and nutrition policy documents and guidelines used to promote healthy and sustainable diets and explore planetary implications
Food system drivers Examining the factors that influence the way food systems function and can respond to transformative efforts	Be able to investigate the influence of food policy, food marketing, food technology and ecological issues on the food supply system
Food supply chain Exploring the phases of the food supply chain that sit within the Australian and global food system	Argue the importance of farming and food systems, including the food supply chain in ensuring safe food from paddock to plate

Source: Table created by authors

only 8% of nutrition and dietetics degrees offered in Australia in 2016 included curricula that addressed food systems, environmental sustainability and/or climate change, with the relevant content provided in 16 unique units (Carino *et al.*, 2020). The recent and marked increase in coverage of planetary health education coincides with greater policy attention and increasing evidence of the bidirectional impact of food systems on planetary health both globally (Willett *et al.*, 2019; Fanzo *et al.*, 2020; Schneider *et al.*, 2023) and in Australia (Australian Government Department of Health and Aged Care, 2023; Hendrie *et al.*, 2022). Another likely contributing factor is the increasing prominence of planetary health and sustainable development criteria within professional competency standards. For example, the most recent 2021 iteration of the DA competency standards (Dietitians Australia, 2021) contain a much greater emphasis on environmental sustainability and the dietitians' role and responsibility to improve food systems (Allen and Palermo, 2022). In addition, the Association for Nutrition, which provides accreditation, has released new Core Competency Requirements for Registered Nutritionists and Registered Associate Nutritionists, whereby "sustainability" features more prominently than previous iterations(Association for Nutrition, 2024). Specifically, the Association for Nutrition frames sustainability within the realm of sustainable dietary patterns that have lower environmental pressure and impact. Whilst the context for this study was nutrition and dietetics, there is little research from other health professions in Australia and elsewhere to determine how quickly they are responding to the urgent need to offer more planetary health education (Romanello *et al.*, 2022; Brand *et al.*, 2021; Lokmic-Tomkins *et al.*, 2024).

While this study has identified an increase in coverage of planetary health curricula, a deeper examination of the coverage and quality of these curricula has identified room for improvement. Whilst 137 unique units were identified, this only represents 6.5% of the total number of units screened across nutrition and dietetics degrees. In this study, learning outcomes were used as a proxy measurement to examine the intended impact on student learning (Allan, 1996). The analysis of learning outcomes relevant to planetary health demonstrated that overall, curricula in nutrition and dietetics degrees prioritised lower-order cognitive learning [e.g. at the "Remembering" and "Understanding" level of Bloom's Taxonomy (Krathwohl, 2002)] rather than more complex categories (e.g. "Evaluating" and "Creating"), particularly for units offered at the undergraduate level. One reason for this could be that health professions' educators, who are responsible for developing curricula, were not likely to be exposed to planetary health curricula in their own training. Educators have self-reported limited capacity to explain, inspire and facilitate planetary health curricula (Brand *et al.*, 2021) and are therefore likely to develop curricula that reflect their own capacity limits. An examination of educator perspectives globally identified disciplinary silos as an additional obstacle, in addition to inadequate professional learning opportunities for educators (Parry and Metzger, 2023). This will continue until there is widespread prioritisation of planetary health outcomes in competency standards. Additional barriers faced by educators as they grapple with offering higher-order cognitive learning opportunities in this emerging field have been identified, such as perceptions that the content is outside of their field or scope of practice and practical struggles with an over-crowded curriculum (Brand *et al.*, 2021; D'Eon, 2023). The evidence is clear that nutrition, dietetics and all health professions must evolve to embrace their broader duty of care for planetary health, including the need to offer fit-for-purpose, responsive curricula to prepare the future workforce. However, health professions educators require further knowledge, skills, training and capacity to offer high-quality planetary health curricula, particularly at the higher end of conceptual learning (Stanford *et al.*, 2023).

Certain topics within the field of planetary health are being prioritised by educators in curriculum development for nutrition and dietetics. Planetary health education addresses global challenges and by its very nature is broad, spanning many disciplines, sectors and geographical contexts (Guzmán *et al.*, 2021). This study provides insights into how planetary health as a broader field is being contextualised for the nutrition and dietetics profession. By examining the subject matter of relevant learning outcomes, this study has revealed that educators are focusing on certain topics. For example, the interconnected relationships between food service systems and planetary health outcomes, individual-level dietary modification towards healthy and sustainable diets, food and nutrition policy to promote healthy and sustainable food systems and examination of the distinct phases of the food supply chain that brings food from paddock to plate. These topics are very specific to the disciplines of nutrition and/or dietetics, focusing largely on food and diets. This is not surprising, given that these topics are also reflected in current discipline-specific competency standards (Dietitians Australia, 2021; Association for Nutrition, 2024), position statements (Barbour *et al.*, 2022) and role definitions (Dietitians Australia, 2019).

In addition to these discipline-specific curriculum concepts, this study reveals a number of underpinning concepts being prioritised that are relevant to other health professions disciplines, facilitated using content more specific to each discipline. The differentiation between content and concept-based curricula has been proposed as an approach to address the issues of content overload and over-crowded curricula in health professions education (D'Eon, 2023). There is also increasing pedagogical evidence to support concept approaches to health professions curriculum design to promote more complex and critical thinking (Repsha *et al.*, 2020). Concepts are mental constructs that require understanding of multiple content areas, which give meaning to the interplay between discrete curriculum content, or facts (Tweedie *et al.*, 2021). When a concept-based lens was applied to the analysis of learning outcomes in this study, concepts such as the intrinsic relationship between human health and natural ecosystems, critiquing the status quo, innovation and disruption, fostering social justice thinking, values-based practice and evidence-based practice were identified. Of note, higher-order learning concepts relating to critique of the status quo and disruption were least commonly encountered within this study, which likely coincides with the prioritisation of lower-order cognitive learning. These concepts are not discipline-specific, and therefore findings from this study may offer insights for other health professions beyond nutrition and/or dietetics. More specifically, the learning outcomes identified and analysed in this study provide examples of what is considered feasible and within scope for educators, as well as some exemplary framing of these complex concepts into a practical learning statement. Evidence suggests that curriculum that prioritises such concepts and moves beyond the acquisition of knowledge about sustainability is proposed to promote deeper levels of planetary health understanding that learners can transfer to professional practice (Holdsworth and Thomas, 2021). Of note, the concepts being prioritised by nutrition and dietetics educators, according to this study, are synergistic with those recommended in recent best-practice education frameworks. For example, the Planetary Health Education Framework by Guzmán *et al.* (2021) presents five foundational domains including the central concept of humans' interconnection within nature. The guidance here is for educators to draw upon multiple ways of knowing, including Indigenous perspectives, to teach the deep interconnectedness of humans as part of nature (Guzmán *et al.*, 2021). This study identified learning outcomes relevant to this domain such as "investigate First Nations peoples' perspectives on the impact of environmental issues on health and wellbeing" with the concept of value-based practice. This provides an example of a concept that is relevant to

all health professions disciplines, which can and should underpin more discipline-specific content.

Research limitations

This study has revealed the current state of play regarding the coverage of planetary health curricula in nutrition and dietetics degrees in Australia by analysing degree information and unit learning outcomes on Australian university websites. However, limiting the analysis to publicly available unit synopses and learning outcomes may have under-represented the true extent of planetary health education occurring in Australian Nutrition and Dietetics degrees. It is likely that additional learning and teaching activities are being facilitated that are not represented in these often word-limited outward-facing statements. Relevant curricula may have also been overlooked as a result of the pre-determined key terms used to identify units of interest. Although this was intentional to refine the scope of this study, it is acknowledged that the field of planetary health is complex and transcends disciplines; therefore, it is challenging to ensure an entirely comprehensive review of all relevant curricula. To address this limitation, future research could use more holistic search terms such as those outlined in the Inner Development Goals framework (Ankrah *et al.*, 2023).

Future research and practical implications

Whilst this study demonstrated increasing coverage of planetary health curricula in Australian nutrition and dietetics degrees through analysis of learning outcomes, future research could specifically examine how planetary health education is being implemented both in teaching and assessment. This study has demonstrated that to truly monitor the changing tertiary landscape in this emerging field, regulatory bodies should require less ambiguous and more explicit reference to curricula relevant to planetary health, sustainable development and climate change in learning outcomes and curricula descriptions. To complement the analysis of learning outcomes in this study, an analysis of assessment activities could provide a more comprehensive review of the current tertiary landscape. Learning evaluation models, for example, Kirkpatrick and Kirkpatrick (2016), could be used to evaluate the impact of planetary health curricula on student learning, behaviours and longer-term results such as changes in planetary health practices. Future research could also seek educator perspectives on the facilitators and barriers to more widespread inclusion of planetary health curricula, both within and beyond nutrition and dietetics degrees. In addition, an examination to understand how comprehensive nutrition and dietetics curricula currently is, compared to non-discipline-specific best-practice frameworks for planetary health, would be helpful to identify concepts and themes being overlooked. Approaches to co-design planetary health curricula with educators, practitioners and students should be explored as a strategy to develop fit-for-purpose education materials.

Conclusion

As urgency mounts for the health-care sector to embrace its duty of care for planetary health, there is pressure on the higher education system to adequately prepare the future workforce in all sectors and disciplines. This study examined two health professions, nutrition and dietetics, and identified that the majority of degrees in Australia (86%) are offering opportunities for students to engage with planetary health curricula. This shows progress when compared to previously published literature, and coincides with greater prominence of planetary health within discipline-specific competency standards. Whilst this increase in coverage is promising, this study also identified that existing planetary health curricula is focused on lower-order learning. Higher-order learning that promotes complex and critical

thinking is required to prepare future nutrition and dietetics professionals to respond to urgent calls for transformative action within health-care and food systems. Regarding the subject matter being prioritised by educators, concept-based curricula applicable to all health professions as well as those specific to nutrition and dietetics were identified. Curriculum concepts of equity, values-based practice and critiquing the status quo were examined and were identified to align with best-practice planetary health education frameworks. The practicalities of how these are being applied in nutrition and dietetics, in terms of the framing of exemplary learning outcomes, offer insights for many disciplines including those beyond health.

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Supplementary material

The supplementary material for this article can be found online.

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