Mapping community gardens in the Australian National Curriculum: A curriculum analysis model

Rachael Walshe, N. S. (Snowy) Evans and Lisa Law
James Cook University, Australia

The Australian Curriculum is a policy document that directly influences the lived realities of millions of students and teachers. However, navigating and understanding the Australian Curriculum can be confusing due to discipline-specific meta-language. This poses problems when attempting to access the Curriculum in research that extends beyond the Education discipline. In response, this paper proposes a novel model that facilitates the analysis of curriculum documents for those outside the Education discipline. To illustrate the method, the paper provides an example of how and where community gardens align with the content descriptions of the Australian Curriculum. A word frequency analysis suggests that community gardens are most closely aligned with the Humanities and Social Science's (HASS) and Health and Physical Education (HPE) learning areas. A word tree analysis thematically groups content descriptions and discusses how community gardens can support classroom implementation of both HASS and HPE. The method presented will benefit scholars outside the Education discipline who seek to engage with the curriculum. It also extends discussions surrounding how to best integrate gardens in schools.

Introduction

Curriculums directly influence the lived realities of current and future learners. Curriculum documents are important for their capacity to have long-standing, real-world effects (van den Akker, 2004). They guide teaching practices and underpin the basic foundational knowledge and skills of future generations. Yet, for all their worth, curriculum documents are hard to understand. Language is often discipline-specific and requires extensive meta-language to break down, understand, and interpret in a meaningful or tangible way. In this sense, curriculum documents tend to be written for educators and exclude, rather than include, trans and cross disciplinary voices. This is certainly what we found when the first author, a geographer, attempted to undertake an analysis of the Australian Curriculum for a project investigating how community gardens can enhance learning outcomes for students in Years P-6.

The research was inspired by our understanding that community gardens have long been recognised as sites of constructive academic learning (Wake & Birdsall, 2016). Community gardens provide inviting or inclusive spaces for teaching STEM education (Krasny & Tidball, 2017), mathematics and English (Ohly et al., 2016), exploring dietary behaviours (Huys et al., 2017), and improving physical health and wellbeing (Ohly et al., 2016; Dyg & Wistoft, 2018), and can encourage engagement with place (Wake & Birdsall, 2016). Yet, when seeking a way to use gardens as tools to enact curriculum, difficulty can arise. For us as researchers, it became apparent that curriculum documents are relatively inaccessible to non-education specialists. We contend that a curriculum is supposed to be a merging of

discourses, encouraging interdisciplinary dialogue (Hemmi et al., 2013). In response, the first author developed a curriculum analysis model.

Curriculum analysis is important. In Lavrenteva and Orland-Barak's (2015, p.654) words, by performing a curriculum analysis, "we can learn a lot about the explicit and implicit approaches and messages carried and conveyed regarding teaching and learning a particular subject matter area". A curriculum analysis model provides a powerful tool for understanding curriculum documents and has the potential to reveal many things, from the social and political values of a particular time period to the cultural dynamics of schools.

Curriculum accessibility is critical for understanding what is to be taught. Making the curriculum easily accessible to those outside education will add multiple specialised and valuable insights capable of bringing a richness of intellectual and disciplinary diversity to deepen student learning experiences. The aim is to open a pathway for specialised knowledge fields outside of education to access the Australian Curriculum and make valuable contributions to student learning. We first provide a review of existing curriculum analyses models. Curriculum analyses are performed in a variety of ways, from comparative or framework analyses, to development, policy, and enactment analyses, each providing new insights. Our review reflects these categories and provides commentary on the positives, challenges/ barriers of the models, and replicability for those outside education. This is followed by the application of the first author's model within a school community garden context that sits across Year P-6 curriculum. The section simultaneously contributes to discussions surrounding how community gardens complement and create opportunity for enhanced delivery of the curriculum. The model will be of use to anyone who has an interest in curriculum analysis.

Curriculum analysis models

Curriculum analysis is an art form, and there are few methods, models, or frameworks for analysis that exist outside the education discipline. A search of the online databases *ERIC, Scopus* and *Informit A+ Education* was conducted in 2021 using a combination of the following search terms: primary school, curriculum analysis, curriculum evaluation, curriculum development and evaluation model. While there was no shortage of review models existing, each had aspects that makes adaptation difficult. Papers that did not provide a descriptive methodology for their evaluation or analysis model were excluded. Out of the models found, four undertook transnational studies across Asia, Europe, Australasia, and North and South America (Derman & Gurbuz, 2018; Hanish et al. 2014; Lavrenteva & Orland-Barak, 2015; Hemmi et al, 2013) The remainder are from Australia (Macdonald et al., 2018; Mosely, 2021), Jamaica (Ferguson, 2008), Israel (Hagar & Tirosh, 2019), Mexico (Anahy Paredes-Chi & Viga-de Alva, 2017), New Zealand (Soutter et al., 2012), United States of America (Land et al., 2019), United Arab Emirates (Tezcan-Unal et al., 2019), and Turkey (Yilmaz et al., 2021). Not all papers focused specifically on curriculum documents themselves. Some focused on the delivery of curriculum, or stakeholder perspectives, and some even focused on supportive materials. We emphasise

that all analyses are valuable in understanding the intricacies of curriculum analysis. Whilst the models presented in this paper are not the only ways to analyse curriculum, they are the only ones found where the analysis methods are explained clearly enough for replication. We now discuss the papers thematically through comparative curriculum analyses and framework analyses.

Comparative curriculum analyses

Each of the transnational studies provides a comparative curriculum analysis, meaning they all compare aspects of, or entire curriculums, across countries. Hanisch et al. (2014) used a categorical framework analysis to understand the 'environmental' potential of syllabi in five schools across England, Germany, Italy, Romania and Spain. They discern that theirs was one of the first transnational, comparative curriculum analyses to focus on the potential of 'greenness' across curriculum syllabi. Using mixed methods research techniques to gain both stakeholder (teacher) perspectives and coded content analysis, they followed recommendations from Mayring (1983, in Hanisch et al., 2014), to paraphrase the original content to create an ease of reading and categorisation. By performing the coded content analyses individually, they can triangulate with great accuracy how the environment is represented across each curriculum. Although acknowledged in the paper, comparing international curriculums means their model relies heavily on participant contributions (surveys and curriculum translation) and could not occur without them.

Also looking at environmental education across different countries, Derman and Gurbuz (2018) focused solely on science curriculums. Again, using coded content analyses as their main data derivative, Derman and Gurbuz summarised the similarities and differences of environmental education presence across curriculums in Turkey, Australia, Singapore, Ireland, and Canada. They deployed both inductive and deductive research approaches, but highlighted that there is no systematic method to their coding. Translating this method would be difficult, as they used an adaptation of a previously developed scale to evaluate the presence of environmental education, yet did not provide the reader with their adaptation. In a similar study, Hemmi et al., (2013) focused on an individual syllabus (mathematics) to compare assistive materials for teachers across Sweden and Finland. They deployed the analytical tool developed by Davis and Krajcik (2005, in Hemmi et al., 2013), which categorised and evaluated the content of teacher material. The model deployed by Hemmi et al. would not be appropriate for analysing a stand-alone curriculum document such as the Australian Curriculum, as it compares across multiple countries and Australia has one curriculum, but it does highlight the varying ways comparative analyses can be performed.

The final comparative study, and the largest, to be discussed under this heading was by Lavrenteva and Orland-Barak (2015). They explored English as a foreign language (EFL) in curriculums across Brazil, Croatia, Ecuador, Egypt, Finland, Hong Kong, Hungary, Israel, Mexico, Norway, Poland, Singapore, Sweden and Czech Republic. They used the Ben-Peretz curriculum analysis matrix, developed in 1977. Their coding is simple to understand and follow, however, the Ben-Peretz model requires a proficient

understanding of student and teacher dimensions (realities and theories), alongside subject content and teacher 'milieu' - things which are less familiar to those outside the education field. Their model, however, is explained in a clearer capacity because the authors break down and visually represent the dimensions (phases) of the research, in comparison to models such as Hemmi et al.'s or Derman and Gurbuz's, making it more user friendly for those outside of education.

Framework analyses

Framework analyses make up the bulk of the curriculum reviews available. This section presents a summary of those curriculum reviews using frameworks and highlights their strengths, weaknesses, and replicability for education novices. Frameworks explored include those that use software tools, draw on predefined matrices or frameworks, and others that heavily rely on stakeholder engagement. The analyses that inspired the novel model presented in this paper are also explained.

The simplest of all curriculum reviews makes use of concept mapping, and word frequency analysis, using software analysis tools to do so. Moseley et al. (2021) sought to understand the representation of 'Design' in the Australian Curriculum. Their word frequency analysis was performed using the software *NVivo* and categorically linked to concepts of design through a critical analysis. However, they focused on a single learning area rather than content descriptions across the entire curriculum. Translating this method was simple, but when looking at the content descriptions, rather than learning areas, the need for a systematic way of critically engaging with the context of both word use and individual descriptions became apparent. If their model had focused on the broader content descriptions, it would be applicable to almost any content analysis setting. Nevertheless, the absence of education meta-language in Mosely et al.'s (2021) paper provides an easier pathway into navigating curriculum than most others, for someone outside of education.

Using predetermined frameworks is a common way to analyse curriculum. Ferguson (2008), in reviewing Jamaica's curriculum, used a form of coded content analysis framework that focused on latent (thematic) and manifest (explicit) content. The review is straightforward, but in using a pre-developed framework for coding (sustainability based) it is difficult to translate to other research themes. Without knowing how the framework was developed, it is problematic to imagine how alternative research themes fit. In another study, Soutter et al. (2012) explored the New Zealand curriculum using a similar method to Ferguson (2008). They adopt a predefined wellbeing framework or 'matrix' and apply it across two phases. The first phase focuses on explicit mentions of wellbeing and the second applies a conceptual lens of wellbeing to guide coding. If the method for developing the wellbeing framework were provided, it might be easier to adapt for an alternative theme. What the papers in this review highlight is that there is a tendency to use frameworks without explaining how the authors adapted their research theme to the framework. This makes it difficult for others to use, especially those who are not familiar with the intricacies of curriculum.

Curriculum analyses need to be explained in easy-to-read formats, otherwise replicating them becomes a complicated task. Yilmaz et al. (2021) used Bloom's taxonomy (Adams, 2015) as a framework for a coded content analysis to evaluate Turkey's preschool curriculum. This method is very valuable to understand how the objectives and goals of a curriculum contribute to child development. However, their explanation for their methods is confusing, complicated and lacks description, making replication of the methodological process much harder. Paredes-Chi and Viga-de Alva (2017) used a framework to analyse the presence of environmental education in the Mexican primary school curriculum. Their framework drew on previous Mexican curriculum theorists to account for cultural sensitivity, and for this reason is not replicable. If scholars were to use this study as a basis for their own, they would need to reinterpret the framework within their own cultural context. This would require extensive work as the model accounts for indigenous knowledge, psychological implications of human-nature relationships specific to their country of origin, and knowledge of local ecosystems (Paredes-Chi & Viga-de Alva, 2017). However, like our own study, Paredes-Chi and Viga-de Alva defined chosen search words based on their theoretical perspective of environmental education, then sought to understand how the search words were represented within learning materials.

Some framework analyses draw on participation from stakeholders, meaning they engage with, and capture, the social responsibility that curriculums have. Tezcan-Unal et al. (2019) used a 'learning organisation lens' as a framework to highlight how tertiary education curriculums can be assessed and changed. A learning organisation lens categorises learning curriculums into three main areas: practices, leadership, and environment. Their model is based on document content analysis, surveys, and a mix of interviews and focus groups. The reliance on stakeholders and multiple phases makes using this framework a lengthy and complicated task. It also draws focus away from the content of the curriculum and shifts it to stakeholder opinion, making it redundant if the content is the core focus. Engaging with stakeholders tends to a trend in curriculum analysis, as Hemmi et al. (2013), Hanish et al. (2014), and Hadar and Tirosh (2019), all also require some level of engagement with stakeholders to complete their analysis. While engaging with stakeholders helps provide interesting perspectives, it makes the method more complex and time intensive, which hinders replicability. Engaging stakeholders also removes the opportunity to do a content analysis alone.

Much like environmental education, mathematics appears to be a popular discussion topic in curriculum. In a US study focusing on materials to support mathematics curriculum engagement in elementary children, Land et al. (2019) suggested that open curriculums are the most beneficial for problem solving. Their use of word frequency analysis gives the data a quantitative richness and is an easily translatable method. Their model creates a complete view of how lessons can best reflect curriculum, but it is not relevant for those who are not considering curriculum enactment, and less tangible for those outside education who do not often engage with enacting curriculum concepts. Mosley et al.'s (2021) and Land et al.'s (2019) models are the only two found that consider the value of using both qualitative and quantitative data which makes for more insightful research (Tashakkori & Teddlie, 2010).

In sum, from our review of the literature, we are able to highlight two things. First, that qualitative analyses are favoured in the curriculum analysis field. Nine out of twelve models reviewed used purely qualitative analysis methods (Derman & Gurbuz, 2018; Ferguson, 2008; Hanisch et al., 2014; Hemmi et al., 2013; Lavrenteva & Orland-Barak, 2015; Paredes-Chi & Viga-de Alva, 2017; Soutter et al., 2012; Tezcan-Unal et al., 2019; Yilmaz et al., 2021). Second, there is a trend of relying on participants to make or give deeper meaning to curriculums (Hadar & Tirosh, 2019; Hanisch et al., 2014; Tezcan-Unal et al., 2019). It is also worth noting that without understanding the milieu of teachers, analysing documents aimed at supporting their role would be difficult for anyone outside of education. While each study contributes new perspectives to curriculum review literature, only Mosley et al. (2021) explicitly outlined their methodology in a way that is easily replicable. Having considered the need for an analysis model that can move across curriculum areas and requires no discipline-specific meta-language (Land et al., 2019; Lavrenteva & Orland-Barak, 2015; Soutter et al., 2012), we now explain our curriculum analysis model.

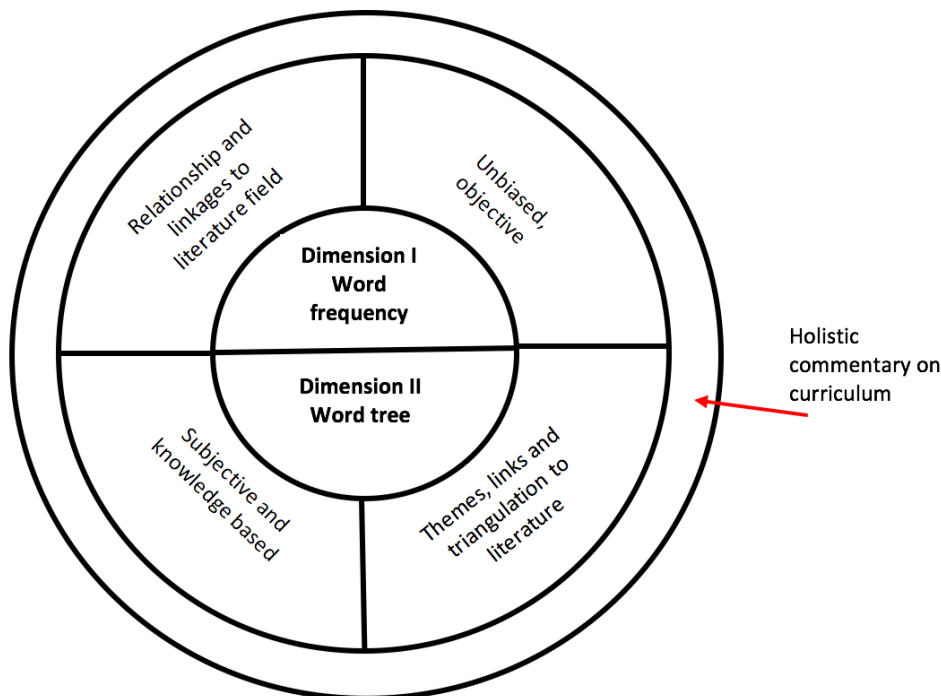## Curriculum analysis model in this study

Figure 1: Curriculum analysis model dimensions and benefits
(adapted from Lavrenteva and Orland-Barak, 2015)

This section describes the curriculum analysis model presented in this paper, and then presents the steps to perform it. The model is a combination of key word frequency and word tree (context) analysis. Our model design follows recommendations from

Tashakkori and Teddlie (2010), who outlined that using a quantitative first cut of data, followed by a more qualitative, subjective phase, creates a valid mixed-methods study. The model is a pragmatic way of highlighting that there are alternative ways of analysing and interpreting curriculums. The following section, where the case study example is presented, explains how the model works in the context of a school community garden.

The novel model presented in this paper is inspired the word frequency and content analyses used by Mosley et al. (2021), and Land et al. (2019). Our model, presented in Figure 1, is visually represented in a style inspired by Lavrenteva and Orland-Barak (2015). The model shows the benefits of deploying both qualitative and quantitative research to create a comprehensive approach for analysing curriculum. Dimension 1 of the model, word frequency, uses quantitative, objective data that creates links to the literature field of choice. Dimension 2, the word tree analysis, allows the researcher to determine themes, links and patterns across the data and create a discussion around it. The model requires only access to the software *NVivo12* and a field of literature.

Word frequency analysis

A word frequency analysis is a computer assisted data analysis technique that measures the frequency of a word's occurrence in a specific document (Cohen et al., 2011). Word frequency analyses are preliminary research techniques, and help researchers decide if there are casual patterns worthy of further investigation (Silverman, 2011). This type of analysis can also assist in creating visual, easily digestible information (Cohen et al., 2011).

To perform the word frequency method for this analysis model there are three phases. The first is to build the master document which contains the keywords (keywords defined by authors in the articles) from a body of literature. Once all the keywords are collated into an *Excel* spreadsheet, they can be run through the program *NVivo 12*, and the top occurring words can be extracted. These become the search terms, or key words (emphasis on the space between these words). This list of search terms, or key words, should be exported into an *Excel* spreadsheet and will become the master document where all further analyses are performed.

The second phase is to run another general word frequency count across the curriculum documents for each year level, again using *NVivo 12*. Once the program has completed this function, export the files into *Excel* documents. These *Excel* files contain a list of every single word used, and its frequency, from each curriculum document. These documents will contain a word, word length, count (frequency), and weighted percentage column. The count column is the important column for this research. At this point begin searching for the presence of the top 50 key words, or search terms, using the list 'CTRL F' (search) function to search. List the count of each of the key words' occurrence, (i.e., 12, or 0), next to the key word in the master document. If it is not present, then place a zero next to the key word in the master document. Once all the key words and their occurrence (if at all) have been compiled in the master document, the final phase of analysis can occur.

Last, using *Excel*, the average, percentage, and sum of key words present in each year level's curriculum document can be calculated. The SUM function adds the count, or frequency, of every key word used for each year level and provides a total number. The AVERAGE function reveals the average number of times all the key words are used in the document (i.e. 5, or 0), and the PERCENT function suggests how much of the total curriculum document is comprised of the 50 key words (i.e., 6%). By performing these basic calculations, it is possible to understand whether their use is significant in comparison to non-search terms and worth further investigation (without using more complicated statistical analyses). The process reveals trends and patterns which can be visually represented in charts and diagrams, and encourages either further investigation, or confirms further investigation is not warranted. The next step in the model is to perform a context analysis using a word tree function in *NVivo 12*.

Word tree analysis

A word tree analysis is a visual information-retrieval technique that allows for rapid, qualitative data extraction from textual documents (Wattenberg & Viegas, 2008). Word tree analysis allows us to engage with literature and create insightful discussions. A key benefit of this method is its ability to provide a snapshot of a singular word's context (Wattenberg & Viegas, 2008). A downside is that if used as a stand-alone technique, the broader document tends to be excluded from analysis. The method is performed by using the 'word tree' function from the text search query in NVivo 12. The parameters for this query should be set to ten words occurring on either side of the search word.

To critically engage with curriculum from a discipline-specific lens such as geography, it is key to consider the context of frequently occurring words. The word tree function reveals the context behind a frequently used word and, when looking at the particular context of interest across the entire document, we begin to find patterns and themes emerging. As language is often discipline specific, the context of words will be interpreted differently depending on the lens applied. This opens the content of the curriculum up for an interesting array of discussions, where new insight into the power and use of a word could arise.

The word frequency and word tree analysis methods outlined above provide both a quantitative and qualitative way of analysing curriculum documents. They help researchers decide whether there is a link between curriculum and literature that is worth exploring. The word tree analysis allows researchers to analyse the context and thematically group words. Coupled, these methods provide a way to analyse curriculum from any specific knowledge field. The following section demonstrates how to apply these analyses. The example research theme is 'community gardens' and is discussed through a Geography lens, from the Australian Curriculum for P-6 (ACARA, 2017), which is the larger scale focus of the research.

Case study example

Background

The Australian Curriculum is a set of policy documents, separated into eight learning areas, that outline the required learning outcomes for each year level in every state and territory in Australia (ACARA, 2017). The eight learning areas are: Mathematics, English, Humanities and Social Sciences, Technology, Science, Arts, Language, and Health and Physical Education (ACARA, 2017). In each learning area there are a subset of content areas containing a set of content descriptions. For example, English has three strands: literacy, language, and literature. Each strand contains a set of content descriptors that provide the specific knowledge, understanding and skills to be achieved within each learning area and year level. It is the content descriptions that are embedded in all eight learning areas that are of interest to us in this paper.

The vantage points are important to consider, and define, for this model to work. This case study looks at learning as a process of inquiry, rather than a listening process (Usher, 2020), as gardens are recognised as outdoor learning sites where children can experience their learning, not just learn from a book (Becker et al., 2017). As the lead author's discipline is geography, implications are that the discussion is interwoven with theories from geography and aligns with inquiry-based pedagogies.

The following section deploys the novel analytical model described above to analyse how and where community gardens align with P-6 content descriptions of the eight curriculum areas pertaining to the Australian Curriculum (ACARA, 2017). We then deploy the model presented above as an example to how it works and synthesise the results of the key word frequency and word tree analysis with a discussion weaved throughout.

Context specific word frequency analysis

The key words for this curriculum analysis are derived from relevant community garden and environmental education journal articles which formed the basis of a literature review focusing on gardens in schools. The literature review search phrases included: 'community garden' OR 'urban agriculture,' 'place-based,' 'environmental education' OR 'place responsive education' and 'primary schools.' When looking for relevant articles, the following journals appeared to be prominent in producing community garden and/or environmental education literature: *The Journal of Environmental Education, Environmental Education Research, Local Environment, Geographical Review,* and *Leisure Studies*

All keywords were collated into an *Excel* spreadsheet and run through a word frequency count using *NVivo 12*. The top 50 keywords were chosen as the key words for searching curriculum documents with. The top 50 are named in Table 1, as best representing the community garden literature.

Table 1: Keywords used to perform the keyword frequency analysis

Rank	Keywords				
1-5	Garden	Community	Urban	Food	Social
6-10	Place	Place-based	Culture	Public	Agriculture
11-15	Nutrition	Learning	Geography	Environment	Environmental
16-20	Cultural	Curriculum	Children	Health	Relationship
21-25	Development	Nature	Engagement	Literacy	Resilience
26-30	Food security	Practice	Pedagogy	Social movement	Science
31-35	Behavior	Wellbeing	Backyard	Landscapes	Economy
36-40	Effectiveness	Subject	Key member	Vegetable	Experiential learning
41-45	Achievement	Sense of place	Colonial	Difference	Cairns
46-50	Management	Empowerment	Political	Rights	Sustainability

The key word frequency analysis of the top 50 keywords in community garden literature revealed that not all the words were present in the Australian Curriculum, Assessment and Reporting Authority's years P-6 curriculum (ACARA, 2014a; 2014b; 2014c; 2014d; 2014e; 2014f; 2014g). There were only 22 in Prep; 21 in Year 1; 21 in Year 2; 24 in Year 3; 24 in Year 4; 28 in Year 5; and 27 in Year 6. The results are represented in a visual manner in the chart in Figure 2, together with the frequency at which the words are occurring within the documents (use 'zoom in' function in web or PDF reader).

Table 2 shows that, on average, 27 (of the original 50) keywords appear in the Year 5 curriculum document 5.26 times each. In total, they also make up for 142 of the 2226 words, which is 6.05% of the entire curriculum document. The results in Table 2 were obtained by running a SUM, COUNT, AVERAGE and PERCENT function in *Excel* on the list of 50 key words against the *Excel* version of the word frequency lists from the curriculum documents. Table 2 also shows these results for Years P-6. Year 2 has the lowest scores for each, suggesting their curriculum is the least aligned with the key words, although almost 5% of the Year 2 document does have some overlap with community garden literature. Based on the weighted percentage, the Prep and Year 1 curriculum documents have similar overlap levels with the community garden literature, and Years 3, 4, and 6 all have a similar level of overlap, suggesting there is something worth further investigation.

Table 2: The average, sum, count, and percentage of word frequency in Years P-6 curriculum (ACARA, 2014a; 2014b; 2014c; 2014d; 2014e; 2014f; 2014g)

Function	Prep	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Count	22	21	21	24	24	27	26
Sum	85	96	91	111	121	142	131
Average	3.86	4.57	4.33	4.44	5.04	5.26	5.04
Percent	4.9%	4.9%	4.4%	5.1%	5.3%	6.1%	5.6%

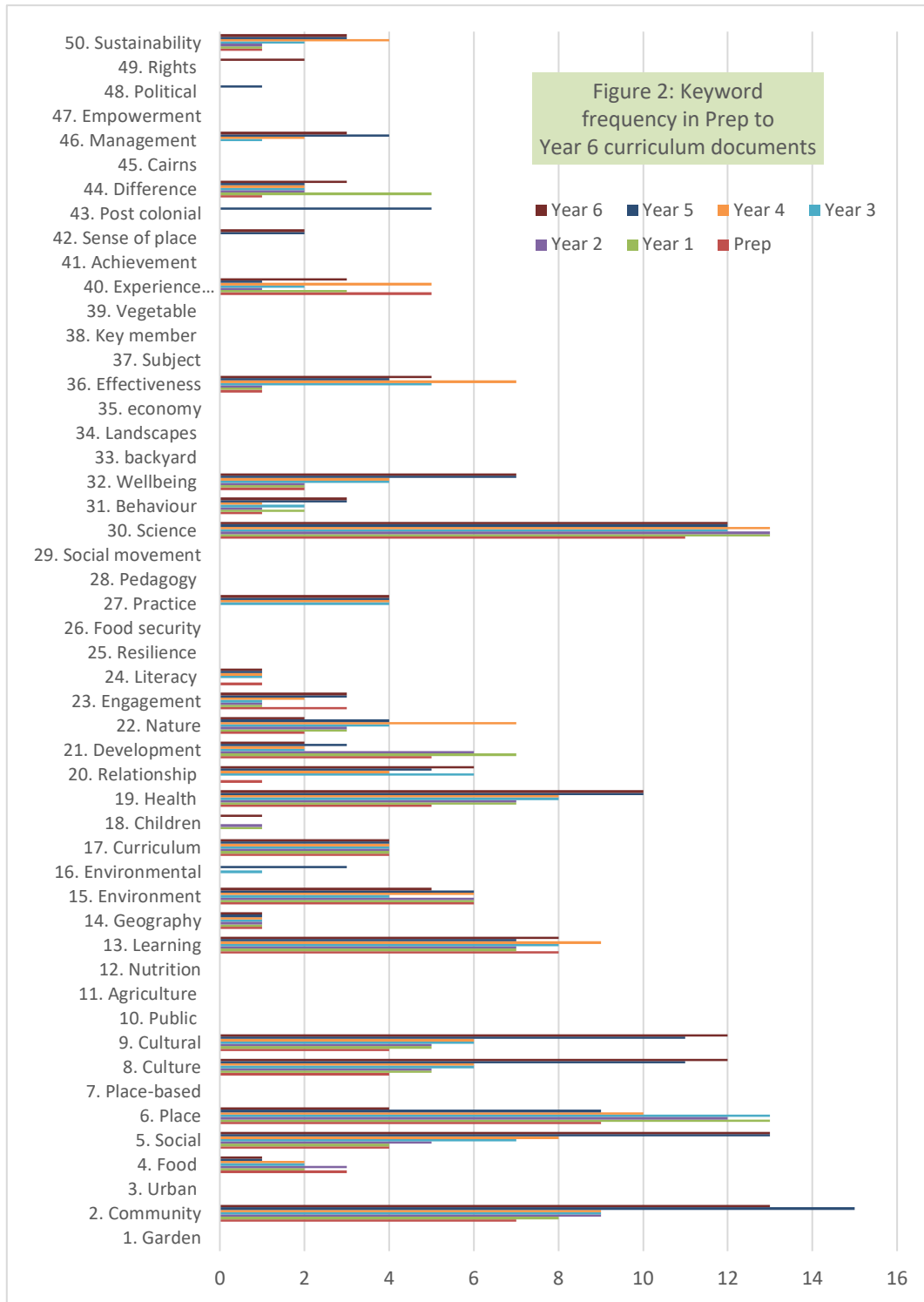Figure 2: Keyword frequency in Prep to Year 6 curriculum documents

Table 2 shows that the highest sum of master keywords present in the content description documents is 142 in Year 5. These 142 words represent more than 5% of the total 2226 words present in the content description document for Year 5. These numbers suggest there is something here worth investigating further, as the words used in the content descriptions from the National Curriculum overlap with the keywords selected from the scholarly literature. While all curriculum documents could be analysed further, the Year 5 frequency suggests this is the most promising from which to draw parallels. Analysing the context of every individual keyword present in the document does not encourage insightful discussion, so the top occurring keywords will be used in the word tree content analysis.

Figure 3 shows the words with the highest frequency across all the analysed documents. 'Community' occurs in the top 20 words, or the top 1% in both Years 5 and 6 content description documents; and in the top 50, or 2.5% in Years 3 and 4. Considering there are over 2000 unique words used in each document, this can be considered a promising factor. A word used often enough to be in the top percentile highlights that it is frequently used. The following seven words will be explored in a word tree analysis: 1 Community; 2 Cultural; 3 Health; 4 Science; 5 Social; 6 Sustainability; and 7 Wellbeing
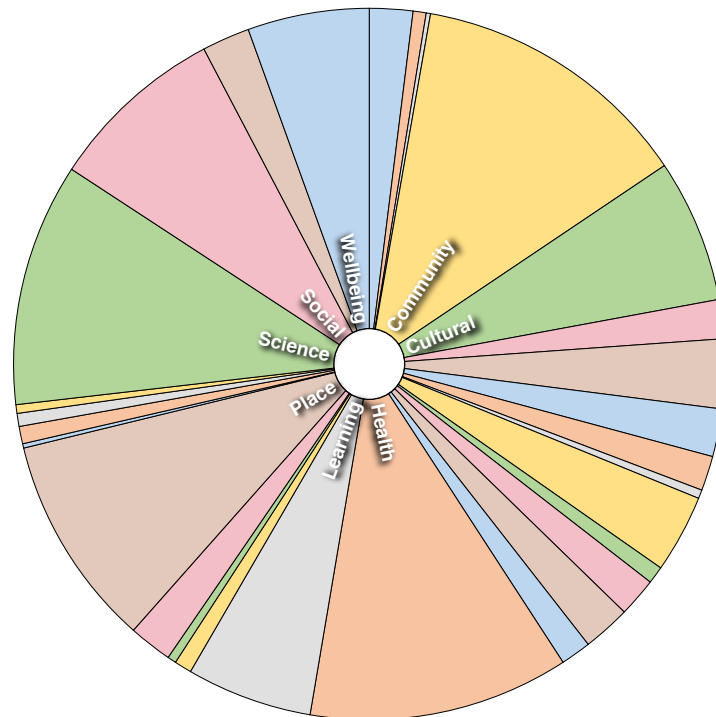

Figure 3: A sunburst chart visually representing the rate
of keyword frequency in Years P-6 curriculum content descriptions
(ACARA, 2014a; 2014b; 2014c; 2014d; 2014e; 2014f; 2014g)

Context specific word tree analysis

This word tree content analysis allows us to focus on the top occurring key words to extract deeper information, such as where each word falls in the content descriptions and how they are used. This is particularly important when thinking about the seven key words from the vantage point of geography or another discipline. By understanding the context of key words in education it is then possible to see shared or deviating meanings. Figure 4 is an example of what a word tree with a search parameter of ten words looks like. The words on either side of the key word give it context and allow us to look for themes and patterns across their use.
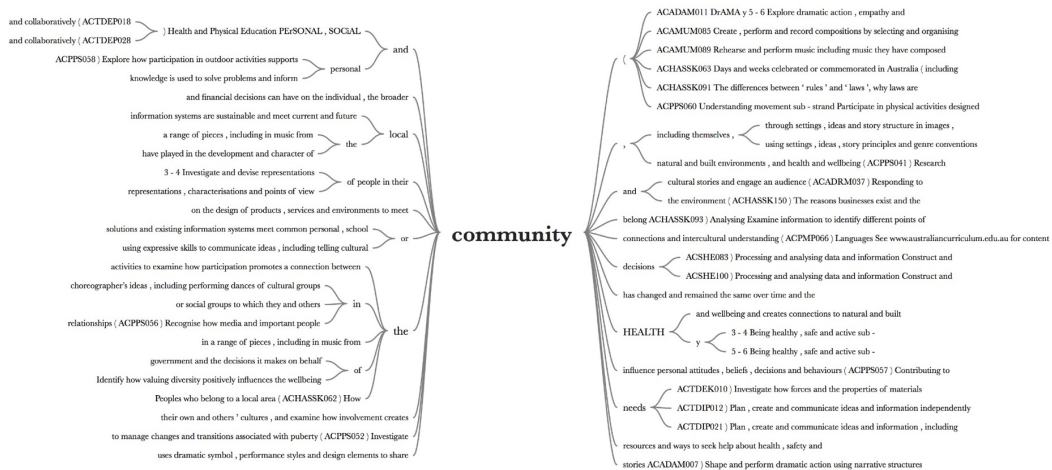

Figure 4: An example of what a word tree looks like using the top occurring key word: community (use 'zoom in' function in web or PDF reader)

The emergent themes from the word tree analysis for the seven key words can be summarised under three headings: 1. Place/belonging; 2. Connection to the natural and built environments; and 3. Identity and heritage. We discuss the key words in the context of these themes with the aim of finding spaces of shared meaning and overlap. How can our specific focus of community gardens provide windows of opportunity to support the implementation of curriculum in the classroom? We now use these headings to explore potential cross-disciplinary engagement opportunities with National Curriculum content descriptions.

Place/belonging

In geography, place has many meanings, inclusive of both the tangible (physical) and intangible (felt). The discipline tends to place equal weight on both meanings, to understand the importance of a sense of place. A sense of place encompasses concepts such as place belonging and place attachment (Scannell & Gifford, 2014), which are important for building long-term resilience and wellbeing. Education in Queensland

places considerable weight on wellbeing amongst students (Queensland Education, 2018). From a geography point of view, building sense of place is considered a gateway to wellbeing and we think community gardens provide one tool to work towards greater wellbeing.

Across Year 4 and 5 Australian Curriculum key words that are frequently used together are health, wellbeing, cultural, social and community. These words often appear coupled or grouped together in the Humanities and Social Sciences (HASS) and Health and Physical Education (HPE) curriculum learning areas. Figure 5 contains excerpts of the content descriptions which were present in the word tree analysis, and reflect the theme of place and belonging.

Communicating and interacting for **health** and **wellbeing** sub-strand (contains learning goals)" – *Year 4 Health and Physical Education*
"The different **cultural,** religious and/or **social** groups to which they and others in the **community** belong (ACHASSK093)" – *Year 4 Humanities and Social Sciences*
"Investigate the role of preventive **health** in promoting and maintaining **health,** safety and **wellbeing** for individuals and their communities (ACPPS058)*" – Year 5 Health and Physical Education*
"Identify how valuing diversity positively influences the **wellbeing** of the **community** (ACPPS060)" – *Year 5 Health and Physical Education*

Figure 5: Excerpts from the Australian Curriculum, Assessment and Reporting Authority (ACARA, 2014e; 2014f), Years 4 and 5 content description documents

The content descriptions in Figure 5 are an example of how Community, Health, Culture, Social and Wellbeing tend to be clumped together. Grouping these key words in content descriptions together highlights their synergies. Literature suggests that safe and connected communities are healthy, diverse and have a collective shared sense of wellbeing (Hooper et al., 2015). Community gardens are often central hubs of connection, acting as spaces that increase sense of place and belonging. Environmental knowing can increase place belonging (Law, 2019) and as gardens are an immersive, natural environment, they enhance environmental knowing (Wake & Birdsall, 2016). But where might opportunities lie in the use of gardens?

Community gardens in schools can support the implementation of the content descriptions presented in Figure 5 as they are spaces where diversity is recognised through food growing practices. Growing food integral to other cultures increases engagement with those outside of someone's social group (Baker, 2004; Kingsley & Townsend, 2006; Kingsley, Foenander & Bailey, 2019). Engaging with those outside of your social group at a particular site increases a sense of place, by fostering a shared sense of place attachment. For this reason, gardens are often used in displaced and fractured migrant communities (Kingsley & Townsend, 2006; Kingsley et al., 2019). Using gardens to assist in implementing content descriptions can contribute to both a felt (intangible) and understood (tangible) sense of place. We acknowledge sense of place as part of both the

natural and built environments but building the connection to these environments is worth exploring further.

Connection to the natural and built environments

Weaved throughout the HPE learning area is the theme of building and maintaining connection to both the natural and built environments. Geographers often consider the connections humans have to the built and natural environments and see green infrastructure as a mid-way between them. Community gardens are green spaces that allow us to explore the natural realm, and our role within it, from a central location within the built environment (Baker, 2004; Walstra, 2021). They provide the opportunity to witness ecosystem services in real-time, such as pollination, the life cycle of plants, habitat provisioning, and climate regulation (cooling). The content descriptions that community gardens support as a type of mid-way point are illustrated in Figure 6.

"Participate in outdoor games and activities to examine how participation promotes a connection between the **community,** natural and built environments, and **health** and **wellbeing** (ACPPS041)" – *Year 4 Health and Physical Education*
"Explore how participation in outdoor activities supports personal and **community health** and **wellbeing** and creates connections to natural and built environments (ACPPS059)" – *Year 4 Health and Physical Education*

Figure 6: Excerpts from the Australian Curriculum, Assessment and Reporting
        Authority (ACARA, 2014e), Years 4 and 5 content description documents

The wording of the content descriptions in Figure 6 is extremely specific and has the capacity to create a reality that immerses children in the two worlds in which they belong (the natural and the built). These descriptions suggest that personal and community health/wellbeing are directly affected by the connection to the natural and built environments. Malone (2007) argued that a child will grow up with increased resilience and wellbeing if given the opportunity to experience and play while immersed in the natural realm. Community gardens also increase passive physical activity which improves overall quality of life (Wake & Birdsall, 2016). By incorporating community gardens into the curriculum, HPE classes could have an increased capacity for instilling the tools for both physical and mental wellbeing.

Identity and heritage

Community gardens are an ideal way to passively engage in the rich, deep heritage of cultures through a single commonality we all share: food. Finally, culture is embedded in everything around us and in everything we do. Geographers understand the cultural landscape as integral to everyday life to the foods we eat, social interactions and world views. It is also an evident theme across the P-6 curriculum (ACARA, 2017). Throughout both HPE and HASS content descriptions the need to understand heritage and identity of both oneself and others is highlighted, this is evident in the examples in Figure 7. Community gardens increase awareness of other cultures and one's own heritage through

food growing practices and citizenship (Baker, 2004). While food is not mentioned in the descriptions, it is a direct connection to culture, and the practices involved in cultivation are a sensorial way of (re)gaining insight and connection to said culture (Bhattacharya, 2021). Content descriptions that place value in understanding culture are illustrated in Figure 7.

> "Research own heritage and **cultural** identities, and explore strategies to respect and value diversity (ACPPS042)" – *Year 4 Health and Physical Education*
> "Participate in physical activities from their own and others' **cultures**, and examine how involvement creates **community** connections and intercultural understanding (ACPMP066)" – *Year 5 Health and Physical Education*
> "The world's **cultural** diversity, including that of its indigenous peoples (ACHASSK140)" – *Year 6 Humanities and Social Sciences*
> "Participate in physical activities from their own and others' **cultures**, and examine how involvement creates **community** connections and intercultural understanding (ACPMP066)"- *Year 6 Health and Physical Education*

Figure 7: Excerpts from the Australian Curriculum, Assessment and Reporting Authority (ACARA, 2014e; 2014f; 2014g), Years 4, 5 and 6 content descriptors in the HPE and HASS curriculums

This creates a sense of belonging to a community as food fosters emotional bonds with others (Pascoe & Wyatt-Smith, 2013; Nettle, 2014). Learning in a garden does not just encourage awareness of other cultures and world geographies, it increases a sense of place and self-representation within the local cultural landscape. Geographers consider we are as much a part of the landscape as it is of us; it is integral to building belonging (Kahn, 2002; Malone, 2007; 2016). Belonging is developed in gardens as where diversity is encouraged and education occurs naturally via engagement, observation, and participation (Kingsley et al., 2019).

When analysing the context of the key words, it becomes clear that some learning areas are more heavily aligned with our research focus. Specifically, the content descriptors pertaining to HPE and HASS align with--and can be supported by--community gardens. This comes as little surprise as community gardens are aimed at being socially inclusive and diverse spaces where non-competitive, passive, physical activity occurs. HPE and HASS also hold culture, health, and wellbeing at the core of their learning and teaching activities. While learning areas such as Technology and Science can also align with community gardens (Bucher, 2017), their content descriptions do not specifically appear in the word tree analysis and thus were excluded from the discussion.

In sum, gardens do not only align with curriculum in numerous ways but can also support implementation of content descriptions in the classroom. This case study was positioned from a geography vantage point but applying another lens would reveal different results. By analysing the presence or use of key words with alternative perspectives, new, or differing insight into gardens use in schools could be uncovered. This would present the opportunity to inform and devise different teaching and learning practices.

Summary

The model presented in this paper fills a gap in the literature by providing a replicable and accessible method for curriculum analysis. Overlaps in the Australian Curriculum and community garden literature fields are revealed through the word frequency analysis, and then unpacked for deeper conversation through word tree analysis. Our example using community gardens showed some community garden literature keywords occurred in the top 1% of words present in the curriculum, and create opportunities for enriching HPE and HASS content descriptions.

Future research possibilities could include looking at the curriculum as a time series, as the new Australian Curriculum is available for viewing in 2022. This would provide an insight into whether ACARA reviews reflect the shift in social values, dynamics, and weights of our current period. This would be particularly useful in understanding terms such as wellbeing and its importance over time. This analytical model could also be used to interpret individual learning areas, such as the Arts, Science, or English.

In this paper we provide a pathway into curriculum analysis, not just for non-specialists, but for anyone interested in understanding the curriculum. As this model is designed to translate to any niche interest, it encourages us to begin merging and synthesising disciplinary discourses. By breaking down the academic barriers of curriculum analysis new paradigms can be imagined, and the core policy document of education, be improved. However, for now it is promising to understand that analysing a curriculum does not need to be an unnavigable task, should we wish to do so again.

References

Adams, N. E. (2015). Bloom's taxonomy of cognitive learning objectives. *Journal of the Medical Library Association*, 103(3), 152-153.
https://doi.org/10.3163/1536-5050.103.3.010

Anahy Paredes-Chi, A., Viga-de Alva, M. D. (2018). Environmental education (EE) policy and content of the contemporary (2009-2017) Mexican national curriculum for primary schools. *Environmental Education Research*, 24(4), 564-580.
https://doi.org/10.1080/13504622.2017.1333576

ACARA (Australian Curriculum, Assessment and Reporting Authority) (2014a). *Content for Foundation - Learning area content descriptions, v8.1 Australian Curriculum.*
https://docs.acara.edu.au/resources/Content_for_Foundation_-
_Learning_area_content_descriptions.pdf

ACARA (2014b). *Year 1, v8.1 Australian Curriculum.*
https://docs.acara.edu.au/resources/Content_for_Year_1_-
_Learning_area_content_descriptions.pdf

ACARA (2014c). *Year 2, v8.1 Australian Curriculum.*
https://docs.acara.edu.au/resources/Content_for_Year_2_-
_Learning_area_content_descriptions.pdf

ACARA (2014d). *Year 3, v8.1 Australian Curriculum.*
https://docs.acara.edu.au/resources/Content_for_Year_3_-
_Learning_area_content_descriptions.pdf

ACARA (2014e). *Year 4, v8.1 Australian Curriculum.*
    https://docs.acara.edu.au/resources/Content_for_Year_4_-
    _Learning_area_content_descriptions.pdf

ACARA (2014f). *Year 5, v8.1 Australian Curriculum.*
    https://docs.acara.edu.au/resources/Content_for_Year_5_-
    _Learning_area_content_descriptions.pdf

ACARA (2014g). *Year 6, v8.1 Australian Curriculum.*
    https://docs.acara.edu.au/resources/Content_for_Year_6_-
    _Learning_area_content_descriptions.pdf

ACARA (2017). *Literature review: Contemporary approaches to comparative education research.*
    https://www.australiancurriculum.edu.au/media/3576/literature-review.pdf

Baker, L. E. (2004). Tending cultural landscapes and food citizenship in Toronto's
    community gardens. *Geographical Review*, 94(3), 305-325.
    https://doi.org/10.1111/j.1931-0846.2004.tb00175.x

Becker, C., Lauterbach, G., Spengler, S., Dettweiler, U. & Mess, F. (2017). Effects of
    regular classes in outdoor education settings: A systematic review on students learning,
    social and health dimensions. *International Journal of Environmental Research and Public
    Health,* 14(5), article 485. https://doi.org/10.3390/ijerph14050485

Bhattacharya, D. (2021). Sourcing, sensing, and sharing Bengali cuisine on the Gold Coast.
    In F. Edwards, R. Gerritsen & G. Wesser (Eds.), *Food, senses and the city* (pp. 143-154).
    Routledge. https://www.taylorfrancis.com/chapters/edit/10.4324/9781003025580-
    11/sourcing-sensing-sharing-bengali-cuisine-gold-coast-diti-bhattacharya

Bucher, K. (2017). Opening garden gates: Teachers making meaning of school gardens in
    Havana and Philadelphia. *Teaching and Teacher Education*, 63, 12-21.
    https://doi.org/10.1016/j.tate.2016.12.003

Cohen, L., Manion, L. & Morrison, K. (2011). *Research methods in education* (7th ed.).
    Routledge. [8th ed.] https://www.routledge.com/Research-Methods-in-Education-
    8th-Edition/Cohen-Manion-Morrison/p/book/9781138209886

Derman, M. & Gurbuz, H. (2018). Environmental education in the science curriculum in
    different countries: Turkey, Australia, Singapore, Ireland, and Canada. *Journal of
    Education in Science, Environment and Health*, 4(2), 129-141.
    https://doi.org/10.21891/jeseh.409495

Dyg, P. M. & Wistoft, K. (2018). Wellbeing in school gardens – the case of the Gardens
    for Bellies food and environmental education program. *Environmental Education Research,*
    24(8), 1177-1191. https://doi.org/10.1080/13504622.2018.1434869

Ferguson, T. (2008). 'Nature' and the 'environment' in Jamaica's primary school
    curriculum guides. *Environmental Education Research*, 14(5), 559-577.
    https://doi.org/10.1080/13504620802345966

Hadar, L. L. & Tirosh, M. (2019). Creative thinking in mathematics curriculum: An
    analytic framework. *Thinking Skills and Creativity*, 33, article 100585.
    https://doi.org/10.1016/j.tsc.2019.100585

Hanisch, A., Rank, A. & Seeber, G. (2014). How green are European curricula? A
    comparative analysis of primary school syllabi in five European countries. *European
    Educational Research Journal*, 13(6), 661-682. https://doi.org/10.2304/eerj.2014.13.6.661

Hardy, I. (2015). Curriculum reform as contested: An analysis of curriculum policy enactment in Queensland, Australia. *International Journal of Educational Research*, 74, 70-81. https://doi.org/10.1016/j.ijer.2015.09.010

Hemmi, K., Koljonen, T., Hoelgaard, L., Ahl, L. & Ryve, A. (2013). Analyzing mathematics curriculum materials in Sweden and Finland: Developing an analytical tool. In *Eighth Congress of the European Society for Research in Mathematics Education*, Antalya, Turkey. http://cerme8.metu.edu/wgpapers/WG11/WG11_Koljonen.pdf

Hooper, C. M., Ivory, V. C. & Fougere, G. (2015). Childhood neighbourhoods as third places: Developing durable skills and preferences that enhance wellbeing in adulthood. *Health & Place*, 34, 34-45. https://doi.org/10.1016/j.healthplace.2015.03.017

Huys, N., De Cocker, K., De Craemer, M., Roesbeke, M., Cardon, G. & De Lepeleere, S. (2017). School gardens: A qualitative study on implementation practices. *International Journal of Environmental Research and Public Health,* 14(12), 1454-1466. https://doi.org/10.3390/ijerph14121454

Kahn, P. (2002). Children's affiliations with nature: Structure development, and the problem of environmental generational amnesia. In P. Kahn & S. R. Kellert (Eds.), *Children and nature: Psychological, sociocultural, and evolutionary investigations* (pp. 91-116). MIT Press. https://doi.org/10.7551/mitpress/1807.001.0001

Kingsley, J., Foenander, E. & Bailey, A. (2019). "You feel like you're part of something bigger": Exploring motivations for community garden participation in Melbourne, Australia. *BMC Public Health*, 19, article 745. https://doi.org/10.1186/s12889-019-7108-3

Kingsley, J. & Townsend, M. (2006). 'Dig in' to social capital: Community gardens as mechanisms for growing urban social connectedness. *Urban Policy and Research*, 24(4), 525-537. https://doi.org/10.1080/08111140601035200

Krasny, M. E. & Tidball, K. G. (2017). Community gardens as contexts for science, stewardship,and civic action learning. *Cities and the Environment,* 2(1), article 8. https://doi.org/10.15365/cate.2182009

Lavrenteva, E. & Orland-Barak, L. (2015). The treatment of culture in the foreign language curriculum: An analysis of national curriculum documents. *Journal of Curriculum Studies*, 47(5), 653-684. https://doi.org/10.1080/00220272.2015.1056233

Law, L. (2019). The tropical backyard: Performing environmental difference. *Geographical Research*, 57(3), 331-343. https://onlinelibrary.wiley.com/doi/abs/10.1111/1745-5871.12348

Macdonald, D., Enright, E. & McCuaig, L. (2018). Re-visioning the Australian curriculum for health and physical education. In H. A. Lawson (Ed.), *Redesigning physical education: An equity agenda in which every child matters.* New York: Routledge. https://www.taylorfrancis.com/books/edit/10.4324/9780429466991/redesigning-physical-education-hal-lawson

Malone, K. (2007). The bubble-wrap generation: Children growing up in walled gardens. *Environmental Education Research*, 13(4), 513-527. https://doi.org/10.1080/13504620701581612

Malone, K. (2016). Reconsidering children's encounters with nature and place using posthumanism. *Australian Journal of Environmental Education*, 32(1), 42-56. https://doi.org/10.1017/aee.2015.48

Mosely, G., Harris, J. & Grushka, K. (2021). Design education in schools: An investigation of the Australian Curriculum: Technologies. *International Journal of Technology and Design Education*, 31(4), 677-695. https://doi.org/10.1007/s10798-020-09572-3

Nettle, C. (2014). *Community gardening as social action*. Routledge. https://www.routledge.com/Community-Gardening-as-Social-Action/Nettle/p/book/9780367600921

Oguilve, V., Wen, W., Bowen, E., Abourehab, Y., Bermudez, A., Gaxiola, E. & Castek, J. (2021). Community making: An expansive view of curriculum. *Journal of Curriculum Studies Research*, 3(1), 69-100. https://doi.org/10.46303/jcsr.2021.8

Ohly, H., Gentry, S., Wigglesworth, R., Bethel, A., Lovell, A., & Garside, R. (2016). A systematic review of the health and well-being impacts of school gardening: Synthesis of quantitative and qualitative evidence. *BMC Public Health,* 16, article 286. https://doi.org/10.1186/s12889-016-2941-0

Pascoe, J. & Wyatt-Smith, C. (2013). Curriculum literacies and the school garden. *Literacy Learning: The Middle Years*, 21(1), 34-47. https://research-repository.griffith.edu.au/handle/10072/56446

Queensland Education (2018). *Student learning and wellbeing framework*. https://education.qld.gov.au/student/Documents/student-learning-wellbeing-framework.pdf

Scannell, L. & Gifford, R. (2014). The psychology of place attachment. In R. Gifford (Ed.), *Environmental psychology: Principles and practice*. (5th ed., pp. 272-300). https://www.researchgate.net/publication/279718543_The_psychology_of_place_attachment

Silverman, D. (2011). *Interpreting qualitative data*. SAGE Publications. [6th ed.] https://us.sagepub.com/en-us/nam/interpreting-qualitative-data/book265719

Soutter, A. K., O'Steen, B. & Gilmore, A. (2012). Wellbeing in the New Zealand curriculum. *Journal of Curriculum Studies*, 44(1), 111-142. https://doi.org/10.1080/00220272.2011.620175

Tashakkori, A. & Teddlie, C. (Eds.) (2010). *SAGE handbook of mixed methods in social & behavioral research*. 2nd ed. https://us.sagepub.com/en-us/nam/sage-handbook-of-mixed-methods-in-social-behavioral-research/book233405

Tezcan-Unal, B., Jones, W. & Littlewood, S. (2019). Curriculum review: Analysis through a learning organization lens. *Innovative Higher Education*, 44(5), 399-415. https://doi.org/10.1007/s10755-019-09472-y

Usher, J. (2020). Is geography lost? Curriculum policy analysis: finding a place for geography within a changing primary school curriculum in the Republic of Ireland. *Irish Educational Studies*, 39(4), 411-437. https://doi.org/10.1080/03323315.2019.1697945

Van den Akker, J. (2004). Curriculum perspectives: An introduction. In J. van den Akker, W. Kuiper & U. Hameyer (Eds.), *Curriculum landscapes and trends* (pp. 1-10). Springer Netherlands. https://doi.org/10.1007/978-94-017-1205-7_1

Wake, S. J. & Birdsall, S. (2016). Can school gardens deepen children's connection to nature? In K. Nairn & P. Krafti (Eds.), *Space, place and the environment* (pp. 89-112). Springer Reference. https://doi.org/10.1007/978-981-287-044-5_1

Walstra, V. (2021). Digging into soil, the senses, and society in Utrecht. In F. Edwards, R. Gerritsen & G. Wesser (Eds.), *Food, senses and the city.* Routledge. https://www.taylorfrancis.com/chapters/edit/10.4324/9781003025580-3/digging-soil-senses-society-utrecht-vincent-walstra

Wattenberg, M. & Viegas, F. B. (2008). The Word Tree, an interactive visual concordance. *IEEE Transactions on Visualization and Computer Graphics*, 14(6), 1221-1228. https://doi.org/10.1109/TVCG.2008.172

Yilmaz, A., Aşkar, N., Yıldız, E. & Sönmez, İ. (2021). Evaluation of 2013 preschool curriculum objectives and indicators according to Revised Bloom's Taxonomy. *Uluslararası Eğitim Programları ve Öğretim Çalışmaları Dergisi*, 11(1), 1-22. https://doi.org/10.31704/ijocis.2021.001

Rachael Walshe (corresponding author) is a sessional academic and PhD candidate in the College of Science and Engineering, James Cook University, Nguma-Bada Campus, Cairns, Australia. Rachael has attained Honours Class I in Human Geography, and a Bachelor degree in Environmental Management (Sustainability and Human Geography). Her research interests explore the role of schools and community garden's ability to address environmental amnesia's effect on the perception of food.
Twitter: @RachaelWalshe3
LinkedIn: https://www.linkedin.com/in/rachael-walshe-b83091115/
ORCID: https://orcid.org/0000-0003-1750-8356
Email: rachael.walshe@my.jcu.edu.au

Dr Snowy Evans is the Associate Dean Learning and Teaching for the College of Arts, Society and Education at James Cook University, Nguma-Bada Campus, Cairns, Australia. Snowy's research background lies at the intersection of sustainability education, pedagogy, schools and initial teacher education. Snowy's current research interests focus on pedagogy and curriculum in pre-service teacher education, within new-materialist frameworks.
ORCID: https://orcid.org/0000-0001-8053-7841
Email: neus.evans@jcu.edu.au

Lisa Law is an Associate Professor in Geography and Planning in the College of Science and Engineering, at James Cook University, Nguma-Bada Campus, Cairns, Australia. Her research focuses on urban spaces in Southeast Asia and tropical Australia, and crosses a wide spectrum including liveability and place-based urban design for the tropics, the meanings and uses of public space, environmentally responsive design, and the role of culture and the arts in placemaking.
Twitter: https://twitter.com/LisaLawJCU
LinkedIn: https://www.linkedin.com/in/lisa-law-48739191/
ORCID: https://orcid.org/0000-0002-0095-7588
Email: lisa.law@jcu.edu.au