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Nature immersions: teaching reading through a real-world curriculum

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Abstract

Debates about teaching reading have long been a part of educational vernacular, frequently reduced to polarised views about phonics. This attention can unnecessarily divert from the cumulative skills required for learning to read and comprehensive research, which indicates the positive influence of systematic phonics instruction on students' reading outcomes. Australian education has recently moved beyond these reading wars to include explicit phonics instruction in a reformed national English Curriculum. This provides an opportune time to engage preservice teachers entering the workforce with strategies that explicitly teach these skills while nurturing young people's ecological consciousness through positive nature connections. With this focus in mind, a participatory action research project involving preservice teachers was undertaken, from which an Eco-Conceptual Framework ensued. The project put immersive activities in place, promoting transdisciplinary ways to develop learners' connections with nature using images collected from participants' real world when learning to read. Results indicate that action research energised preservice teachers' perceived knowledge, self-efficacy about teaching early reading utilising place and skills in designing visual resources. It brings attention to the critical influence of preservice teachers' dispositions and preferred natural spaces on what images are collected and offered when designing early reading activities utilising the natural world.

Background: The Educational Nexus

Three significant circumstances together have created a particular time in Australian education. The most critical and long-term condition is the environmental crisis, with human activity impacting the ecosystem on a planetary scale. Nearly a decade has passed since the release of the United Nation's Sustainable Development Goals [SDG] (United Nations, 2022), and necessary attention to climate action appears to have temporarily taken backstage due to the domination of society's attention on the COVID-19 pandemic (OECD, 2021).

As an integral part of society, education has also incurred large-scale changes in response to political and public health directives for physical distancing during the pandemic. These have involved rapid pivoting to remote learning at population levels impacting 1.6 billion teachers and their students globally (Gonzales & Xavier, 2021). These impacts have affected pedagogical practices by taking education indoors. As COVID-19 restrictions ease and on-site learning is reactivated, effects on schools continue. These include teacher shortages, student absenteeism, hybrid learning, disease mitigation measures and learning recovery plans to maximise learning outcomes (Giannini et al., 2022).

Amidst these circumstances, Australian schools are also dealing with national curriculum reforms, which have inadvertently aligned with directives to reactivate onsite learning. Associated challenges of returning to classrooms are coupled with significant teacher professional development and planning for implementation. While schools in Australia's six states and two territories implement the reformed Australian Curriculum in their jurisdictions, NSW is the first state to implement its reformed state-based K-2 English Curriculum. Despite the timeline variations, there are universal priorities for humanity that must not be lost during curriculum transitions. This includes critical multilateral advancement of the global environmental agenda for the survival and restoration of the planet (United Nations, 2022).

Australian Education is well placed for moving through curriculum reform while retaining necessary short and longer-term responses to global environmental challenges through a three-dimensional curriculum model. This model includes learning areas (subject content), general capabilities (skills), and cross-curriculum priorities (values, attitudes, and dispositions). The three dimensions allow general capabilities and cross curriculum priorities to provide foundational support across the curriculum, in this case, fostering connections with nature without disregarding the specificity of discipline content outcomes. This *interdisciplinary design* offers *transdisciplinary reach* and is recommended as the best way to prepare students for the 21st Century by developing young learners' ecological consciousness, collective capacity building and lifelong commitments to caring for a planet in environmental crisis (Fam et al., 2017; Jefferson & Anderson, 2020).

However, it is also recognised that while environmental education has increased in scholarship and dominance as a global paradigm, effective interdependence, mobilisation and promotion of such areas across schools vary (Kolleck & Yemini, 2020). Considering this paradigm, the juncture in Australian education is a timely opportunity to ensure ecological approaches that immerse young learners in the natural world are realistically actuated as teachers implement curriculum changes (ACARA, 2022).

Coming Out the Other Side of Recovery
English curriculum reform and the three-dimensional curriculum model

The recently released Australian Curriculum V9.0 includes a stronger focus on phonics in the English subject and a stripping back of content so that the curriculum can be taught with further depth and rigour (ACARA, 2022). Similarly, the reformed NSW English K-2 Syllabus for the Australian Curriculum reciprocates the increased focus on foundational literacy and learning the alphabetic code. Australian teachers are undertaking Teacher Professional Development [TPD] to support the successful implementation of these curriculum changes.

In NSW government schools thus far, the TPD for the K-2 English Syllabus has required teachers of Foundation Year to adhere strictly to externally produced, decontextualised lesson sequences without deviation. This approach supports research identifying the critical influence of explicit and systematic phonics instruction on students' reading skills and later reading success (National Reading Panel, 2000; Scarborough, 1998). However, compartmentalising essential early reading skills places associated risks on the three-dimensional curriculum model by excluding opportunities for incorporating connections with nature in early reading. Instead, these connections are predominantly linked with HASS and Science, negating opportunities for approaches that build young learners' connections with the natural world alongside foundation reading outcomes.

A similar dominance is found in the research literature, where sustainability concepts are predominantly connected through HASS, Science, PDHPE and the Arts, undertaken in later primary schooling (Auld et al., 2021; Magntorn & Helldén, 2006). Limited research investigating approaches for developing students' nature connections and dispositions when developing young learners' phonemic and phonological skills exists. Research into early reading focuses more on nature play and discovery (Constable, 2017). Those studies investigating opportunities for

nurturing children's imaginings about sustainability through the English discipline focus on oral and written storytelling and children's literature. Again, these critical contributions to the scholarship are undertaken in later primary schooling (Hannigan & Ferguson, 2021; Riley & White, 2019). Despite these limitations, research indicates the benefits of nature-based experiences for developing human connections and dispositions to care for the more-than-human world in profound, long-lasting ways that start early in life (Cole & Malone, 2019; Riley & White, 2019; Von Braun, 2017).

These views resonate with eco-psychology, which identifies that personal connections between humans and the natural world are nurtured when people are engaged in and by place (Louv, 2008; Orr, 2011). For young learners, in particular, the research identifies that developing dispositions for the natural world by *experiencing place* begin early in life; in the local, and that these early formed dispositions positively affect an individual's gratitude and capacities to act for all living ecologies in their adult civic life (Greenwood, 2020; Sobel & Larimore, 2020; Von Braun, 2017). The attainment of these dispositions and *environmental consciousness* can be termed *eco-capacities* and can organically complement the explicit teaching of early reading.

In alignment with *Place-Based Education [PBE], contemplative engagements* in nature offer slow, purposeful, kinesthetic and nonjudgmental awareness building of the ecosystem (Beuhler, 2021; Richardson et al., 2021). Additionally, these *all-senses embodiments* are known to have positive, long-term effects on people's emotional and social development, particularly in educational settings (Alme & Reime, 2021; Charles & Senauer Loge, 2012). However, in educational settings, we also need to consider the role of the teacher.

The teacher's aesthetic appreciation

A teacher's knowledge is one of the essential mediators enabling children's nature connections and eco-capacity cultivation. Yet, teacher knowledge alone is not sufficient for developing students' *eco-capacities*. Scholars agree that another influential factor affecting students' *eco-capacities* is teacher self-efficacy. The Teachers' Sense of Efficacy Scale (Tschannen-Moran, Woolfolk-Hoy, & Hoy, 1998), based on Bandura's model of self-efficacy (1997), emphasises the association between teachers' self-efficacy and students' educational outcomes. Teachers who have a greater belief in their capabilities to bring about intended learning outcomes are more likely to explore various methods of instruction and develop creative instructional materials (George et al., 2018).

In addition, teachers' dispositions toward sustainable patterns of living influence their effectiveness in sustainability implementations (Andersson et al., 2013). These personal views do not seem to change, irrespective of the school they are working in. This further reinforces the imperative to nurture teachers' *eco-capacities* (Lijmbach, Van Arcken, Van Koppen, & Wals, 2002; Semen, 2020). Scaling-up educators' *eco-capacities* is not limited to schools. UNESCO's (2018a) Global Action Program argues that developing preservice competencies is also necessary. Yet, varying degrees of effectiveness for embedding sustainability concepts across Initial Teacher Education [ITE] exists (Brandt et al., 2021; Malandrakis, Papadopoloulou, Gavrilakis & Mogias 2019).

The Inquiry

From this premise, working with preservice teachers in ITE was central to the inquiry. It investigated the influence of participation in place-based activities for teaching early reading and the impact of this approach on preservice teachers' dispositions, self-efficacy, and perceived knowledge about incorporating place-based experiences in their future teaching practice. While recognising research with preservice teachers differs from working directly with teachers and students in schools, ITE is an essential dimension in the educational movement, which needs to become more alive and consistently intertwined (Cebrian & Jenyent, 2015; Semen, 2020). Thus, the research sought to bring answers to the following research question:

What impact does a transdisciplinary approach to teaching through a real-world curriculum have on developing preservice teachers' pedagogical knowledge and self-efficacy to incorporate nature experiences when teaching young learners to read?

Methodology

Participatory Action Research [PAR] was deemed most appropriate for this project because it sought to empower preservice teachers through a participatory material experience. This approach foregrounds participant agency, allowing the university facilitator to take on a mentoring role as participants actively engage in a systematic sequence of one cycle (Kemmis & McTaggart, 2005).

The single cycle of PAR was also deemed appropriate for the ITE context because preservice teachers are confined to one implementation cycle within a subject. Accordingly, the research sought to measure the effect of active agency in a place-based experience on preservice teachers regarding their:

1. *Theoretical understanding* and *curriculum knowledge* about place-based explorations.
2. *Motivation* and *self-efficacy* to develop young learners' *eco-capacities* through place-based experiences.
3. *Skills for planning* transdisciplinary place-based education when teaching explicit phonics instruction in early reading.

Informing factors

The mandated curriculum informed the content, and theoretical principles informed the conceptual approach from which the project was framed and designed to include:

1. *Explicit teaching* of early reading skills and curriculum content learning outcomes in the Foundation Year of schooling.
2. *Ecological transdisciplinary learning* opportunities during explicit teaching.
3. *PBE* for *ecocapacity* building.
4. *Contemplative experiences in nature* for paying close attention to planet biodiversity.

Study design: participants and setting

Preservice teachers from an English specialism subject, 'Language in Use', were invited to participate in the study. The teaching resource they were asked to produce as part of the project was within the subject assessment requirements. The subject is offered to ITE students studying the Primary or Secondary stream ($n = 30$). However, with the focus on early reading skills, the project invitation was confined to those in the Primary stream ($n = 11$), and all eleven members accepted the invitation to be involved.

The limitation of working with eleven preservice teachers in a participatory action research project is acknowledged. Yet the opportunity to map patterns of influence from an embodied experience, even with a small group of preservice teachers, contributes to the knowledge about transdisciplinary approaches to environmental education in ITE (De Plessis, 2019; UNESCO, 2018b). Small qualitative studies, like the one reported here, can still be generalised because while a context is situated in unique ways, reflecting on the nuances in any given context can act as a launching pad for other similar contexts differentiating from generalisability but contributing to the universal body of knowledge.

It is also recognised that while teachers rarely act independently in schools, not all schools are directed towards whole-school environmental initiatives. Consequently, not all graduates will find themselves in an eco-driven school, leaving them to initiate and build broader contributions that

nurture *eco-capacities* at class, year, or stage levels. Providing eleven preservice teachers with a quality toolkit to implement sustainable imaginings with young learners is a step in the right direction for seeding their eco-capacities for teaching future students and working in school communities (Almeida et al., 2018; Frank, 2019).

Implementation

Phase One: diagnosis and reflection

In 2019, a diagnosis of the content in the English suite of subjects identified the need for revisioning and renewal. Significant course development ensued to include explicit teaching of early reading theories and systematic phonics instruction for all preservice teachers studying ITE (Primary). One core subject for first-year students was targeted, and a second was developed for final-year students undertaking English specialism to ensure all graduates would be prepared to teach this critical aspect of the English curriculum.

The research project was assigned to the final year subject for two reasons. Firstly, preservice teachers would have completed five professional experiences in schools, bringing prior teaching experience to the task. Secondly, they would have acquired pre-requisite research experience from a core subject titled 'Teacher as Researcher', which provided them with experience in undertaking an action research project while on professional experience.

At the commencement of this inquiry, participants completed a pre-implementation online survey that utilised a five-point Likert scale containing six multiple-choice questions. The questions focussed on participants' perceived knowledge about:

1. The terms phonemic awareness and graphological skills.
2. The stage where these early reading skills are taught.
3. PBE for teaching early reading skills.

A question was also included to learn more about their self-efficacy in teaching this aspect of reading. Analysis of the results informed a subject content adjustment for the cohort while aligning with Course Learning Intentions and relevant learning objectives being:

1. Language and meaning in English: word and within word levels.
2. Current approaches to teaching English, literacy and language in the NSW and Australian curricula.

Phase two: action planning and reflection

Participants subsequently engaged with the online learning module and prerequisite academic readings for knowledge-building. A synchronous workshop was then undertaken. As part of the engagement activities, they explored commercial visual resources for teaching phonemic awareness. They specifically evaluated the following:

1. Images representing objects for practising speech sounds in the initial position of a spoken word.
2. Types and prominence of objects represented.
3. Degrees of object familiarity.
4. Compositional effectiveness of the images used.

Facilitator support was provided during the collaborative evaluations, and participants were encouraged to offer beneficial alternatives for creating effective early reading resources. This step was followed by explaining the action-taking phase of the project (Table 1).

Table 1. Sequence of the required task

Task:
You will self- select a preferred outdoor locale that provide opportunities for a rich selection of objects around a particular field. You will take photographs to compile a set of objects that capture the 26 consonant sounds, the short vowels and long vowel sounds in the first position of a word. Using these photos, you will construct a set of stimulus cards and a game using the cards for practicing phonemic awareness OR graphological skills.

1	Self-select an outdoor nature dominated space in a preferred locale
2	Photograph objects in the selected place which represent all single phonemes (or graphemes) for the 26 consonant and vowel letters, including the short and long vowel sounds in the first position of a word
3	Use these photos to construct a set of picture cards and associated gamified activity for developing phoneme or phoneme-grapheme relations to use with young learners in Foundation or Year One
4	Share your task cards and game in a preservice teacher makerspace forum and critically review the task from both teacher and student perspectives.

Phase three: participatory action-taking

The project was implemented. Participants collected visual data and created a set of visual cards utilising their photographs. The cards were then used to create an original game for practising phonemic awareness and graphological skills.

Phase four: evaluation

In a subsequent preservice teacher maker space, participants shared their visual data set and the games produced from their place-based data collection. A shared reflective practice followed, where challenges and opportunities for implementing this activity with young learners were discussed. An evaluative dialogue amongst the group offered solutions to data collection challenges, giving the group ownership over the process and practice they should experience in their future schools. Their created resource was then submitted as a university-approved assessment for the subject.

Phase four: reflection

The assessment also required participants to submit a 350-word individual reflection about utilising young learners' local landscape to develop early reading skills. They also reflected on the embodied experience regarding their self-efficacy and perceived knowledge about implementing these transdisciplinary approaches.

Phase five: planning for learning and reflection

After the maker space and shared discussion, participants undertook a post-implementation survey. It utilised the same question foci as the preimplementation survey, which applied a five-point Likert scale containing six multiple-choice questions. The intention was to measure changes (if any) in their perceived knowledge about teaching phonemic awareness. As with the preimplementation survey, a question required them to rank their self-efficacy for incorporating PBE when teaching early reading skills.

Visual Data

Teacher as the producer of visual resources

The teaching resources produced by the preservice teachers were purposefully and predominantly visual. As such, the photographs taken by the preservice teachers to create the resources were

analysed to learn more about what and how visual meaning was offered to their potential students. The decision to focus on visual meanings is informed by the work of Ronald Hepburn beginning in the twentieth century regarding environmental aesthetics and Arnold Berleant's subsequent Engagement Model (1995). This body of work brought attention to the neglected aesthetic aspect of nature and identified that the first step in developing stewardship for 'place' is to establish connections through pleasurable experiences of the aesthetics in 'place'. We move forward to the twenty-first century, where arguments about the growing dominance of images are made (Kress & Van Leeuwen, 2010), so much so that understanding this modality can be taken as a given, underestimated, or ignored, bringing its own set of complications (Bates, 2018).

Secondly, 'visual semiotics' is understood to have a close functional association with oral and written language and is a suitable modality to utilise when learning to read. And thirdly, from a sociocultural viewpoint, personal dispositions influence producers' choices and prominent attention to matter (Sava et al., 2020). Therefore, understanding more about the images selected by the group of preservice teachers was essential for analysis because if images are not neutral players in what and how concepts are taught and learnt, what teachers select can, in turn, influence what and how their students select and interpret images (Berleant, 1995; Ryan, 2011).

A visual semiotic approach was taken to analyse the visual resources produced by the preservice teachers using a detailed theory-informed analytic template (Table 2). It was based on the following theoretical assumptions:

1. Images are sites for enacting social relations and transmitting attitudes and values. They can express, validate, challenge or change perspectives about a place.
2. The producer of an image plays a role in what is attended to and selected in place.
3. Images can be produced from different vantage points, possibly resulting in the domination, omission or overlooking of meanings.

Preservice teachers' products

The data containing 286 photographs were de-identified and analysed after assessment grades were finalised so as not to interfere with the university assessments or bias the grade achieved for those within or outside the research project.

Key Findings

Patterns emerging from the data analysis centred on:

1. Perceived content knowledge,
2. Demonstrated content knowledge, and
3. Self-efficacy.

Regarding the created reading resources, emerging patterns from the content analysis identified:

1. Place,
2. Item selection,
3. Item preferences, and
4. Spatial organisation.

Preservice teachers' perceived content knowledge

Analysis of the pre-implementation survey indicated limited 'perceived' knowledge about phonemic awareness and how to teach this aspect amongst the group. Nine of the eleven participants

Table 2. Category-coded visual analytic template for hierarchy one

Content		Biotic features																
Field and agents		Celestial features					Protists				Flora					Fauna		
What	Where	Sun	Moon	Sky/clouds	Stars	Water	Soil	Air	Minerals/rocks	Grass	Edible plants	Native/exotic	Trees/shrubs	Fungi	People	Native/exotic	Wild/domestic	

Abiotic features					Expressive content		Compositional analysis													
Man-made objects		Circumstance of means				Affective character-istics		Spatial organisation							Logic of figuration					
In activities	Objects	Setting	Person/people	Place/objects	Light source	Ambience	Colour	Focus	Intervals	Depth	Vanishing point	Eye-level	Gaze	Short distance	High-low angles	Oblique-frontal	Hot spots	Vertical pos.	Horizontal pos.	Framing choices	Multiple/single	Focus

had not undertaken formal learning about phonics before this subject, with two participants indicating they had some understanding of the skills with an introduction in another elective subject (unnamed). Unanimously, no participant had prior experience or knowledge about strategies for teaching reading utilising place. Despite this limited perceived knowledge or expertise in the proposed approach, half of the group indicated an interest in learning more.

The post-implementation survey indicated a positive change in all members' perceived content knowledge, with nine participants marking a two-index improvement in curriculum and pedagogical knowledge questions. Two of the eleven participants rated their understanding of phonemic awareness as proficient, with a four-index improvement on the Likert scale. All participants indicated increased knowledge about strategies involving teaching reading utilising PBE and that the approach would support teaching early reading skills to young learners.

Preservice teachers' demonstrated content knowledge

Submissions were graded according to demonstrated knowledge about the Systemic Functional Model of Language, PBE, transdisciplinary practices, the creation of visual resources, and academically supported justifications for the pedagogical approach. The marking criteria were:

1. Connection to the syllabus and accurate collection of a photographic data set.
2. Application of photographs to produce a multimodal teaching resource.
3. Critical reflection on teaching the Functional Systemic Model of Language using contemporary pedagogies.
4. Academic conventions and writing.

All submissions achieved a credit grade or above, with four high distinction grades. These academic results indicate that the approach offered opportunities for demonstrated knowledge-building across the cohort about teaching early reading skills incorporating PBE.

Preservice teachers' self-efficacy

Before participating in the project, ten of the eleven participants rated their self-confidence at the lowest scale in the survey question related to their ability to teach the targeted early reading skill. Only one of the eleven participants stated feeling slightly confident in this area. The degree of change in self-efficacy was not as prominent as the preservice teachers' perceived content knowledge improvement. However, the post-survey data indicated positive growth in their self-efficacy and confidence in teaching early reading skills. The written self-reflections consistently expressed participants' value for learning to read through a 'real-world curriculum'.

Curriculum-based outcomes are at the heart of this interactive activity that pushes students to build upon their vocabulary and engage with familiar elements of the environment (Self-reflection #2, 09 October 2020).

While the project cannot report on implementation with young children, the positive growth indicates a strong possibility of operation, with one graduate who accepted a primary school teaching position indicating their intent to implement this pedagogical approach in their classroom (Email correspondence, 25 October 2020).

Content analysis: the products

The content analysis of visual data included categorising places selected by participants, the items within those places and the compositions used to capture visual meaning across data sets to identify patterns in the chosen images and associated vocabulary for young learners to practise their early reading skills.

Figure 1. Photographed biotic objects in phonics games. Biotic objects used in a garden game for practising initial phonemes and graphemes.

Compositional interpretation: place

The content analysis began with identifying the sites of production. While the location variance might not be surprising, findings indicate that even with a small number of participants, the activity was operational across metropolitan, coastal, and inner-city areas, warranting its applicability to varied school contexts and places. Fourteen different locations were identified. Metropolitan places dominated, making up over half of the chosen locations across Greater Sydney. These were predominantly urban backyard gardens but also included local parks and streetscapes. More remote coastal, mountain and bush sites were the second common locations, with one of the eleven data sets using Taronga Park Zoo as a coastal city area situated on the shores of Sydney Harbour. However, inner-city locations were least preferred, with only one data set selecting the university grounds and areas within the university walls.

Objects in and across the data sets were also analysed because it is understood that information organised around an overarching theme better links objects, cueing cognitive associations and triggering affective responses (Halliday, 1973). From this notion, the data sets representing objects from one locale could be thought to better assist young children's affective reactions to object naming predictions. It could also be suggested that the more familiar the place and objects within, the greater the ease of object prediction. By reducing cognitive load this way, young learners can focus on the targeted phonemic, phonological and graphophonic skills where the place becomes naturally intertwined in the learning, not a barrier to it (Figure 1). This finding brings questions about the effectiveness of commercial resources, like those analysed before the data collection, which pictures animals and objects outside of children's common everyday experiences such as a 'zebra' or 'seahorse'.

Compositional interpretation: item selection

An analysis of the 286 self-selected objects within locations was then undertaken. While it is logical to expect that item variance differed respectively to the places selected, patterns in the range and frequency of items chosen assisted in understanding more about what participants attended to from each place more generally. As such, a mapping of the items and associated vocabulary was undertaken because the written linguistic system helps identify the effectiveness of items selected for teaching phonology to young learners.

Common nouns were predominantly used across data sets for initial phoneme identification. For example, a 'flower' /f/. However, one data set included common and scientific plant classifications which significantly increased the complexity of item identification and subsequent difficulty of phoneme matching. For example, the common noun 'plant' could have been used instead of the botanical name, Aloe Barbadensis Miller (proper noun). The participant's choice to use botanist names was justified as a multidiscipline approach linking vocabulary with a Science Unit of Work using a trial-and-error process in a guessing garden game to 'promote oral

Figure 2. Botanical names increased task complexity. Photographed Aloe Vera in a garden with labelled initial grapheme for the botanical name and a name card for use in a treasure hunt game.

discussion' (Self-reflection #2, 09 October 2020). However, using botanical names in spoken and written language added another degree of complexity regarding ease of item identification, speed, and fluency, which could detract from the targeted learning intentions for novice learners (Figure 2).

While common nouns were predominantly selected, 15 photos captured action verbs across four data sets. Further problem-solving was required when using still images that presented action verbs. For example, it was unclear if the photo targeted the noun (person) or the action they were carrying out (e.g., trekking or walking). These variances impacted the marker's ease and speed of initial phoneme identification.

Content interpretation: item preferences

Despite the differences in the language features selected and that which one could expect concerning location variances, commonalities in item preferences were identified. As shown in Table 3, biotic or abiotic items were the most preferred types of images across the visual data sets, being selected twice as often as other types.

A closer analysis of biotic items across data sets indicated flora as the dominant choice, with 171 of the 286 objects representing plant varieties. The second most frequently selected items, irrespective of location, were native animals (excluding Homo Sapiens). As a subset of biotic items, photographs of water as a protist category appeared twice as often as other items within this category.

The least photographed objects within locations were celestial images, with the moon targeted in only one photograph. This finding corresponds with the use of moonlight in only two photos and candlelight in one other. Four shots utilised artificial electric light sources to photograph indoor objects (i.e., a lift, door handle and signage). The other 279 pictures were taken during the day utilising natural daylight, indicating a preference in time and location.

Light, as a subset within the classification of colour, is understood to evoke mood and atmosphere (Kress & Van Leeuwen, 2010). While recognising the contribution of this element, digital colour effects such as increased contrasts, mock moonlight, filters, and under or over-exposure to heighten or reduce realism were not used in any photographed objects. It could be concluded that conceptual photos used to inform viewers use light to make the targeted object most accessible to viewers and not to evoke interpersonal connections.

Compositional interpretation: spatial organisation

In addition to analysing the content of images, how objects are organised within a picture contributes to meaning. Therefore, this aspect of visuality is part of the data analysis, and spatial arrangements were examined by considering distances, perspectives (viewpoint), hotspots and eye levels.

Table 3. Biotic and abiotic items for hierarchy two

Content image analysis			
Classification	Feature	Object	Frequency
Biotic features (265 in total)	Celestial	Moon	2
		Sky/cloud	1
		Stars	–
		Sun	1
	Protists	Air	Intuitive
		Minerals /rocks	8
		Grass	16
		Soil/mulch	10
		Water	41
	Flora	Edible plants	25
		Fungi	2
		Small plants (native/exotic)	80
		Trees/shrubs	21
	Fauna	Australian native	36
		Exotic or import	9
		People	22
		Pets	12
Abiotic features (130 in total)	Man-made (targeted objects not appearing as circumstance of means)	Transport	8
		Garden/building tools	21
		Maps/signs	14
		Clothing	11
		House & components	24
		Leisure & sport equip	20
		Musical instruments	2
		Statues	5
		Work/technical equip	25

Distance is often used to evoke degrees of connection with viewers and what is going on in an image. In pictures functioning to entertain or tell a story, the further away, the less social or interpersonal connection; conversely, the closer together, the greater the interpersonal relationship. Of the data sets, 225 of the 286 images used close-up shots. This effect increased the visibility of the targeted object. Using distance this way also increased the salience of the targeted object by directing the viewer's eye towards the most prominent object (as a hot spot) in the photo. Long shots were used to photograph objects far away from viewers in the real world, such as the moon, rather than to evoke lesser degrees of personal connection. No other in-camera effects were used to create sweet spots, panning or fisheye effects which exaggerate the depth of field, with 264 of 286 images using a single vanishing point.

Figure 3. Item identification assisted by technology drawing tools. Photographed garbage bin in a garden and two eggs in a nest are outlined using yellow lines to bring attention to the identified objects.

Another visual element historically associated with evoking cultural and social relations is perspective (Rose, 2016). However, for data collection in this study, perspective appeared to function similarly to distance and eye level, which positioned viewers as direct observers of objects undisturbed in their natural habitat rather than their personal connection to it. That is, viewers were set up to look up at the moon from a viewing platform, alongside a coastline at distant waves, or to look down at ground-dwelling fauna or flora. We could assume these results relate to the conceptual function of the objects photographed rather than a narrative function that seeks to entertain, evoke a story or develop social relations between the viewer and the maker.

Degrees of position can also contribute to power and personal connection by implying whose eyes the viewer is looking through to view an image. All 286 images placed viewers as the camera's eye in frontal or off-centre positions. Positioning viewers this way requires no mediation from other participants in the image (e.g., over the shoulder) or from the producer (e.g., showing the producer's hands or part thereof). Termed focalisation, unmediated positions allow unobscured contact with targeted objects in their settings, this position was unanimously preferred by all group members.

The use of colour also directed viewers' attention to targeted items. Two of the eleven data sets utilised photoshop to highlight a targeted item within a setting. Highly saturated yellow lines and red arrows were used to direct viewers to the targeted object. As demonstrated in Figure 3, the circled item marks out a noun (egg), discounting other possible items that appear in the natural setting (e.g., grass, ground, leaves, fence or twigs). As obvious as this strategy might seem, individual teachers' capacity to utilise technology in this way was not universal and impacted the effectiveness and clarity of item identification. These findings indicate that the function of an image depends on the purpose and that visual literacy capabilities cannot be taken as given in ITE.

Preservice teachers' self-efficacy

Before participating in the project, ten of the eleven participants rated their self-confidence at the lowest scale in the survey question related to their ability to teach the targeted early reading skill. Only one of the eleven participants stated feeling slightly confident in this area. The degree of change in self-efficacy was not as prominent as the preservice teachers' perceived content knowledge improvement. However, the post-survey data indicated positive growth in their self-efficacy and confidence in teaching early reading skills. The written self-reflections consistently expressed participants' value for learning to read through a 'real-world curriculum'.

Curriculum-based outcomes are at the heart of this interactive activity that pushes students to build upon their vocabulary and engage with familiar elements of the environment (Self-reflection #2, 09 October 2020).

While the project cannot report on implementation with young children, the positive growth indicates a strong possibility of operation, with one graduate who accepted a primary school teaching position indicating their intent to implement this pedagogical approach in their classroom (Email correspondence, 25 October 2020).

Limitations

In addition to the limitations previously noted and those acknowledged with interpretational studies, COVID-19 also limited data collection requiring adjustments to the original research plan. Due to physical distancing regulations, the interactive maker space was conducted via Zoom, which impacted how the preservice teacher displayed and shared their resources. While the advantage of technology afforded individual showcasing and discussion amongst the wider group, the conversation was not recorded because the maker space included preservice teachers across the cohort and beyond those who had consented to be in the research group. Thus, data was not available for transcribing and analysis. However, anecdotal notes indicated overarching enthusiasm and interest in discussing the process, the selection of outdoor spaces and the resources developed from the visual data (Researcher notes, 20 October 2020).

A future longitudinal study involving early graduate teachers would provide opportunities for comprehensive data tracking. These data could continue to investigate the longevity of teacher self-efficacy and motivation for implementing place-based approaches for teaching early reading skills initiated in their ITE degrees. A comparison of implementation approaches across demographics and working with young children in Foundation Year could also be undertaken.

Discussion

The final discussion is structured around the field of play, the effect of participatory embodied experiences in ITE that can be applied to teaching early reading skills encompassing a place-based approach. A subsequent assemblage of the concepts and approaches used in the project resulted in developing an Eco-Conceptual Framework to inform transdisciplinary curriculum implementations that promote young learners' ecological consciousness from their first year of schooling. The framework contributes to the body of knowledge about the importance of PBE in developing life-long connections to the natural world and a propensity to act for the planet in these critical times (Louv, 2008; Magntorn & Helldén, 2006; Malandrakis et al., 2019; Orr, 2011).

Scoping the field: what?

Findings indicate that participatory place-based approaches in ITE can support preservice teachers' perceptual and actual knowledge-building about a transdisciplinary curriculum that involves teaching children through a real-world curriculum. The project also demonstrated the capacity to implement embodied experiences across urban, metropolitan, regional, rainforest and coastal places—and that these experiences can be vibrant, appreciated and personalised.

Effects of participatory action research: so what?

Linking theory with future practice through material experiences offered preservice teachers an opportunity to experience an all-senses engagement with place and reflect on the process of transdisciplinary approaches for teaching reading. The embodied experience also provided opportunities for preservice teachers to discuss implementation challenges from a real-life scenario to tease out problems encountered and reduce the likelihood of these issues occurring when implemented in schools. These types of 'close-to-practice' experiences can assist preservice teachers in learning how to manage tasks and their expectations. I argue that the embodied in-nature
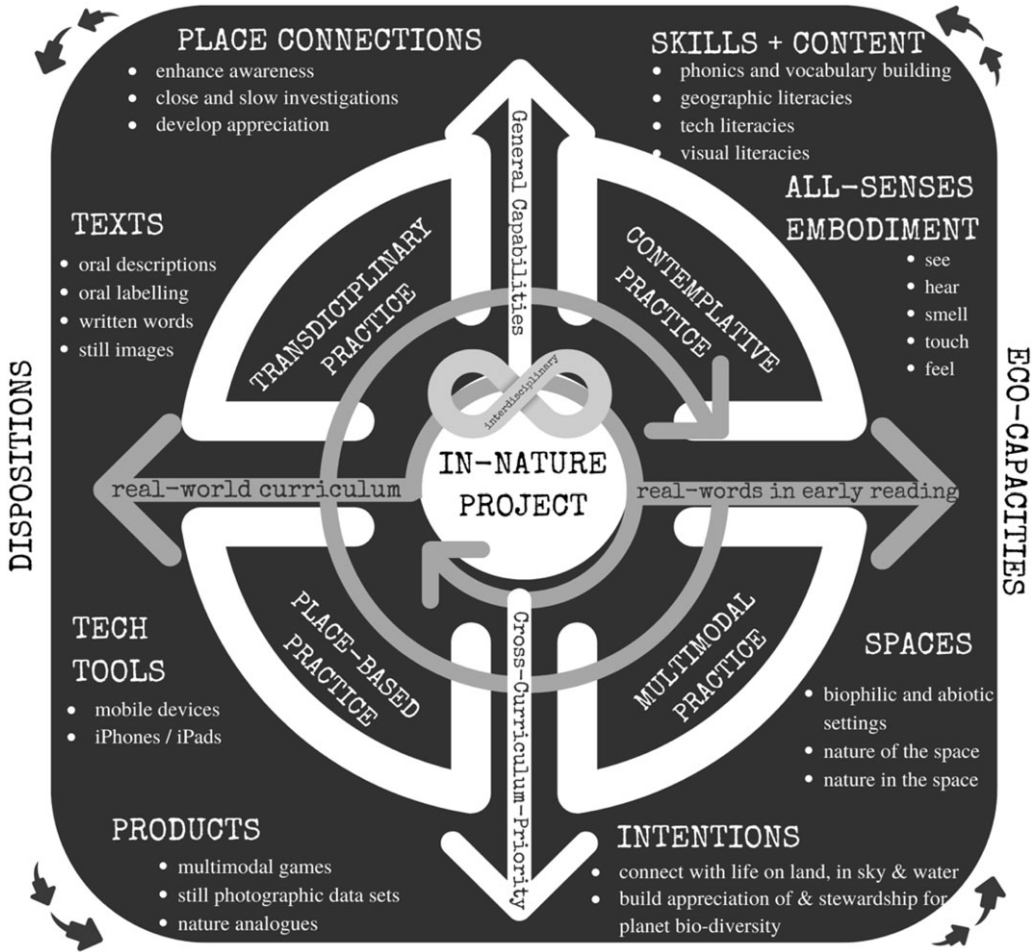
Figure 4. Eco-conceptual framework. Graphic design identifying the concepts, skills, processes, products and pedagogical approaches for embedding eco-practices involving exploring in the real world for early reading activities and strategies for a transdisciplinary eco-conceptual pedagogical approach.

activities experienced by a group of ITE preservice teachers opened them to using transdisciplinary methods that attune young learners to their local natural world, contributing to the knowledge about eco-capacity building in educational settings (Bates, Teudt, & Collier, 2019; Greenwood, 2020; Riley & White, 2019).

While acknowledging the necessity and complexities of implementing widespread environmental movements across educational systems, the project builds knowledge about how ITE can nurture preservice teachers' *eco-capacities* through active, transdisciplinary PBE experiences. Influencing preservice teachers' *eco-capacities* plays a role in emancipating graduate teachers ready to teach young learners in the Anthropocene because 'it has to be us, and it has to be now' (Thunberg, 2019).

Futures-focused classrooms: now what?

Theoretical constructs, curriculum requirements, teaching resources, and pedagogical practices underpinned the design of the in-nature activities conducted in this research project. The PAR

cycle resulted in preservice teachers preparing, experiencing, designing resources, and reflecting on the experience to utilise this approach with young learners in schools. The elements under-pinning the project were assembled to form an Eco-Conceptual Framework to accompany the Australian Curriculum (Figure 4).

The Eco-Conceptual Framework aims to nurture ecological consciousness in transdisciplinary ways from the first year of school. At the centre of the framework, local in-nature experiences focus on the observed biotic and abiotic life. These all-senses embodiments integrate place-based and contemplative practices and are supported by:

- Multimodal practices and tech for data collection tools (relative to access).
- Multimodal practices that create products photograph objects from children's real world and use those actual words to practise early reading skills.

The framework considers external policies, mandated curriculum requirements and practices that school communities can embed greener, more resilient forms of being and doing that is mean-ingful, localised and organic. It seeks to guide preservice teachers in their training, bringing atten-tion to personal dispositions, object selections and preferences on what places are selected and what images are collected—in turn, being mindful of these preferences and student agency when selecting images and designing in-nature activities for young learners. The framework offers a transdisciplinary way to evolve eco-conscious teaching practices that are evidence-based, theoret-ically informed and address the environmental agenda for the survival and restoration of the planet positively when teaching early reading skills.

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