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The Cape to City Education Programme: an internal review

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The Cape to City Education Programme: an internal review

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Objectives

- To review the Cape to City education programme, which promotes conservation and biodiversity knowledge through actions in schools within the Hawke's Bay region.
- To document and evaluate teacher practice and student engagement as a result of participating in the Cape to City education programme.

Methods

The Cape to City education programme is evaluated using a targeted literature review, online surveys (issued to participant teachers and a non-participant teacher control group), and analysis of existing environmental actions and changes in knowledge and attitudes by teachers and students as a result of the Cape to City education programme to date.

Results

The literature review[1] endorses the benefits of environmental education (EE) for students and links to aspects of the Cape to City education programme. While EE programmes have been shown to improve student academic achievement, build positive environmental awareness and engagement, create healthy environmental attitudes, and increase environmental actions, few studies in the literature review attempted to empirically isolate the characteristics of a programme to measure outcomes. However, the review does provide insights into how EE programmes can build student resilience and well-being by lowering anxiety, reducing boredom, and increasing their engagement at school. Key learning skills, such as critical thinking, problem solving, decision making and team building, also have benefits for future learning, and applying these programmes in an outdoor setting will assist with connections to nature. The positive impacts of EE can be enhanced through cross-curricular engagement, the use of school gardens or other natural outdoor habitats, the use of drama, storytelling, engagement with green buildings, framing through conservation, and the creation of a holistic experience that conveys a complete idea or story within an educational context.

The documented actions and outcomes of schools, teachers, and students involved in the Cape to City education programme are numerous and compelling. Examples include the acquisition and application of new knowledge across the curriculum, and actively engaging and connecting students and teachers with the environment. Successful environmental actions include: wetland development, riparian planting, pest monitoring and trapping, installation of small-scale solar energy systems, and novel environmental

[1] The literature review used the key words 'environment' and 'education' in the search, which resulted in Environmental Education (EE) research articles being identified. However, the Cape to City education programme is broader than EE and focuses on cross-curricula, place-based biodiversity education set in an outdoor environment context. Reference to EE programmes in the literature review should therefore be considered in this context.

research. Many of these environmental actions were student-led. In addition, partnerships between schools and a range of community groups and other external organisations were established as a result of participating in the Cape to City education programme.

The two surveys carried out by Cape to City education programme participants and a control group attempted to measure the impact of the Cape to City education programme. However, due to the timing of the survey and a subsequent low response rate by participants in the Cape to City education programme, the survey was only able to give indicative results. However, there is strong support for the Cape to City education programme and indicators that the programme is beneficial to both teachers and students engaging in them. The teachers involved in the programmes see positive cross-curricular environmental learning that benefits the whole school and wider community. Overall, the education programme participant group has demonstrated stronger environmental beliefs and attitudes, greater environmental knowledge, and a greater number of environmental actions were undertaken when compared to their control group colleagues. However, whether these benefits are due solely to the Cape to City education programme or to the inherent nature of the programme participants who volunteered is difficult to determine.

Conclusions and recommendations

The overall conclusion drawn from this review of the Cape to City education programme is that the programme is delivering successful hands-on, inquiry-based environmental learning for students in the Hawke's Bay region. Teachers and students have engaged enthusiastically with the programme and have increased their environmental knowledge, changed their attitudes towards the environment in a positive manner, and carried out significant environmental actions. Most teachers involved in the programme also reported that they have embedded environmental principles into their everyday teaching practices. The literature review informed both the design of the surveys and the thematic analysis of the benefits of environmental education programmes. We categorised these as increasing student engagement, lowering anxiety, improving decision making, and creating a stronger bond with nature.

A key finding of the literature review was that Environmental Education programmes are highly successful at meeting knowledge and competency outcomes but are not quite as successful at measuring changes in dispositions and behaviours (Ardoin et al. 2018). This research provides a limited evaluation of the Cape to City education programme's engagement with both teachers and students. A quantitative impact assessment has not been achieved due to the low response rates to the survey and potential bias in the design. The literature review, however, does confirm the importance of regular evaluation and research assessment before, during, and at intervals after the completion of a programme.

A core component of the Cape to City education programme is the relationship established between teachers, community groups and other organisations and it is important that these are maintainesd and developed further within the school community. The Cape to City education programme has a strong and important partnership with EIT Hawke's Bay that will ensure developing teachers learn about the programmes and the

environmental contexts for education will continue to be embedded into their Bachelor of Teaching Early Childhood and Bachelor of Teaching Primary education courses.

Finally, the Cape to City education programme is founded on a sound model for engaging with schools in the Hawke's Bay, which includes building partnerships, taking a holistic approach and setting long term goals. Through aspirational visions; understanding; new skills, convenient design, delivery and management systems; trust; change moments and reinforcement, there will not only be environmental benefits to enhance the biodiversity of the Hawke's Bay region but also positive social and cultural benefits for the whole community.

1 Introduction

The New Zealand Biodiversity Strategy 2000–2020 "*provides an integrated response to New Zealand's declining biodiversity*" and encourages opportunities for communities to be involved in biodiversity management. Goal 1 focuses on community and individual participation and awareness and encourages children and adults to learn about biodiversity through environmental educational programmes. It also supports individuals within management agencies, researchers and professionals, iwi and hapū, to share their knowledge. The strategy recognises the need to "mainstream" biodiversity concepts in broader environmental education programmes and to make biodiversity information relevant to people's local environments so they can connect with the biodiversity in their places and how it contributes to their lifestyles (NZBS 2000).

Cape to City and Poutiri Ao ō Tāne are two landscape-scale restoration projects that bring together public and private conservation efforts to create a positive difference for New Zealand's native biodiversity in the Hawke's Bay region (Te Matau a Māui). The Cape to City project's vision is "native species thrive where we live, work and play" and Poutiri Ao ō Tāne's vision is Kia haruru a Maungaharuru, Kia ukiuki a Tangitū, Whāriki ora a Papatūānuku – From Maunga to Moana flourishes an environment for future generations to enjoy. The projects are working towards habitat restoration and enhancement, predator control, and native species reintroductions across Hawke's Bay to deliver positive social, cultural, and environmental benefits.

Poutiri Ao ō Tāne is an 8,800-ha ecological restoration project which was established in 2011. The restoration is located on the Maungahāruru Range, encompassing Boundary Stream Mainland Island and its surrounds. Cape to City is a 26,000-ha ecological restoration project that was established in 2015. The restoration is located between Hastings and Cape Kidnappers, encompassing Waimarama and forest remnants at Kahuranaki. Partner organisations involved in the projects to date include the Aotearoa Foundation, local hapū, landowners, Cape Sanctuary, Department of Conservation, Hawke's Bay Regional Council, and Manaaki Whenua – Landcare Research.

The Cape to City and Poutiri Ao ō Tāne projects have also partnered with local schools to provide hands-on education. Young people of Hawke's Bay will be future decision makers for New Zealand, so the goal of the Cape to City's education team is to inspire them to connect with nature and encourage healthy biodiversity in Hawke's Bay. This review focuses on the Cape to City education programme.

Caveat

The term Environmental Education (EE) was used in the literature search. In New Zealand, there is a common perception among educators that EE is a one-off education activity, e.g. a school camp, because in the past EE was linked with "Outdoor Education" in the Health and Physical Education curriculum. Outdoor Education implies a structural detachment from typical school lessons.

However, EE is only one of the elements in the **Education for Sustainability (EfS)** curriculum, which has a much broader meaning in New Zealand; see

http://nzcurriculum.tki.org.nz/Curriculum-resources/Education-for-sustainability#collapsible1

> *"Mō tātou te taiao ko te atawhai, mō tātou te taiao ko te oranga"*
>
> *"It is for us to care for and look after the environment to ensure its well-being, in doing so we ensure our own well-being and that of our future generations"*

A key component of the EfS curriculum is the integration of the concept of sustainability across **all** the learning areas. The Cape to City education programme is broadly based on the EfS curriculum and Future-focus theme of sustainability and are typically set in the context of the outdoor environment. The Cape to City education programme weaves place-based biodiversity education across the NZ Curriculum learning areas. While the Cape to City education programme is not the EE programmes typically outlined in international literature, the outcomes do align with the EE process.[2]

2 Objectives

The objectives of this report are:

- To review the Cape to City education programme which promotes conservation and biodiversity knowledge through actions in schools within the greater Cape to City region.
- To document and evaluate teacher practice and student engagement as a result of participating in the Cape to City education programme.

3 Methods

Methods used to evaluate the success of the educational programmes include a targeted literature review, questionnaires, and evaluation of existing historical data.

The literature review explored environmental education as an enabler of positive learning outcomes throughout the school curriculum. The SCOPUS database was used to carry out the literature review of relevant published environmental education papers from 2002 that focused on primary or secondary school students. Search terms included: (TITLE-ABS-KEY ((Education* or school*) and environment*) AND TITLE-ABS-KEY (program* or outreach or engage*)) AND PUBYEAR > 2002. The results are presented in Section 4.

School children were assessed indirectly by eliciting information on their behaviour and attitudes from school teachers and the Cape to City education programme facilitators.

[2] In the United States, the Environmental Protection Agency (EPA) defines EE as a process "that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment. As a result, individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions" (Stern et al. 2013).

These attitudes and behaviours are considered in the context of the wider school curriculum and are presented in Section 5.

Paper and electronic questionnaires (using survey monkey) were sent to 48 teachers involved in the Cape to City education programme. This questionnaire contained 36 questions. A second, abridged questionnaire (control) with 28 questions was sent to principals of schools involved in the Cape to City education programme but with instructions to forward the questionnaire to teachers not participating in the Cape to City education programme; therefore, acting as a control group. A summary of these results is presented in Section 6.

Finally, conclusions and recommendations are presented in Section 7.

4 Literature Review

4.1 Findings

A total of 256 citations resulted from the SCOPUS database search and 50 peer-reviewed articles were identified as being relevant after reading the abstracts. The key words used in the search resulted in papers from the field of Environmental Education being identified. As outlined in the caveat, Environmental Education articles from the literature review may not refer to cross curricula activities as developed for the Cape to City education programme. However, of these 50 articles, 19 met the researcher's objectives of the review and were analysed and synthesised accordingly. The articles identified did not include tertiary or higher education student learning or preschools.

In the past 25 years, Environmental Education (EE) research has grown in output, scope, and types of design (Ardoin et al. 2018) and in this literature review 10 of the 19 articles have been published since 2017. Table 1 lists these articles and provides a summary of the author(s), year of publication, article title, journal title, methodology used in the research, age range of students, the setting and time frame of the research. The articles were published in four journals: *Environmental Education Research* (8 articles), *Australian Journal of Environmental Education* (4 articles); *Journal of Environmental Education* (3 articles); and *Applied Environmental Education & Communication* (4 articles).

A diverse range of research methods are used and include: literature reviews, case studies, focus groups, semi-structured and in-depth interviews, surveys, document analysis, observation analysis or a mixed method approach combining two or more of these methods. All 19 articles in this literature highlight the benefits of environmental education for school children. The age range, setting, and time frame varies widely between the nineteen articles.

Two systematic literature reviews were identified in this literature review – Stern et al. (2014) and Ardoin et al. (2018). They both analysed EE programmes that used empirical evidence to identify beneficial outcomes. To understand what was working and to identify promising approaches for future EE initiatives, Stern et al. (2014) evaluated the outcomes of EE programmes from 1999 to 2010 for youth (18 years and under). An overall finding of

the review was that few studies attempted to empirically isolate the characteristics of programmes responsible for measured outcomes. Positive benefits of EE programmes identified in this review are outlined in Section 4.2. Ardoin et al. (2018) analysed peer-reviewed literature from 1994 to 2013 and focused on the outcomes of EE programmes with students from kindergarten to twelfth grade. While most of the 119 articles identified reported positive findings, the review suggested that a key benefit of EE programmes was their versatility and the opportunities available for bolder and even more diversified approaches in research design and thinking.

A nationwide study of forty school programmes in the United States showed that in all schools, students who received environmental education performed better on standardised exams and had a greater interest in learning as well as self-esteem about their ability to learn (Scott Kozak & McCreight, 2013).

Insights from this literature review are synthesised into the following key themes: Evaluating environmental education programmes, building positive environmental awareness and engagement, connectedness to nature, community links, and engaging with environmental issues.

Table 1 A list of the nineteen relevant articles identified in the literature review and a summary of the journals they are published in, research method used, student age range, setting and length of Environmental Education programme. (K = kindergarten, N/A – not applicable)

	Authors/Year	Title	Journal	Research method	Age range	Setting	Length of programme
1	Aguirre-Bielschowsky et al. (2012)	Influences on children's environmental cognition: a comparative analysis of New Zealand and Mexico	Environmental Education Research	Interviews with principals & teachers	9–11 years	Mexico and New Zealand primary schools	N/A
2	Appleby (2005)	Mrs Blue Gum, Some Puppets and a Remnant Forest: Towards Sustainability Education through Drama Pedagogy	Australian Journal of Environmental Education	Case Study	Year 5	Primary school, Brisbane, Australia	4 weeks
3	Ardoin et al. (2018)	Environmental education and K-12 student outcomes: A review and analysis of research	Journal of Environmental Education	Systematic Literature review	K-12	N/A	N/A
4	Beery & Jørgensen (2018)	Children in nature: sensory engagement and the experience of biodiversity	Environmental Education Research	Mixed Method: interviews and observation analysis	Adult childhood & K (1–6 years)	Sweden & outdoor kindergarten Norway	Observations over 10 months
5	Boeve-de Pauw & Van Petegem (2017)	Eco-school evaluation beyond labels: the impact of environmental policy	Environmental Education Research	Survey	Grades 6-12	Eco-school project, Flanders Belgium	N/A
6	Braun & Dierkes (2017)	Connecting students to nature – how intensity of nature experience and student age influence the success of outdoor education programs	Environmental Education Research	Adult and student surveys	7–18 years old	Singapore	Embedded in eco-school policy
7	Chan et al. (2017)	Environmental education in nature reserve areas in southwestern China: What do we learn from Caohai?	Applied EE and Communication	Document analysis	Primary school	Caohai Nature Reserve, China	12 weeks
8	Cole & Altenburger (2017)	Framing the Teaching Green Building: environmental education through multiple channels in the school environment	Environmental Education Research	Mixed Method:	Grades 6–8	North American teaching green schools	Various
9	Curtis et al. (2014)	Drama and environment: Joining forces to engage children and young people in environmental education	Australian Journal of Environmental Education	Mixed method: Case studies with survey and observation analysis	Various	Theatres, Australia	5 case studies of various lengths

10	Dieser & Bogner (2016)	Young people's cognitive achievement as fostered by hands-on-centred environmental education	Environmental Education Research	Knowledge questionnaire	4th & 5th grade	Bavarian Forest National Park	1 week + follow-up
11	Flowers & Chodkiewicz (2009)	Local communities and schools tackling sustainability and climate change	Australian Journal of Environmental Education	Case study	N/A	New South Wales, Australia	N/A
12	Scott Kozak & McCreight (2013)	We grew it! enrichment through gardening in elementary school	Applied EE and Communication	Case study and literature review	K – 2nd grade	US School garden	Student-led 6-week collaboration
13	Lebo & Eames (2015)	Cultivating attitudes and trellising learning: A permaculture approach to science and sustainability education	Australian Journal of Environmental Education	Mixed method case study	14 years	Permaculture garden in	31 days over 12 weeks
14	Mahasneh et al. (2017)	Reading social stories in the community: A promising intervention for promoting children's environmental knowledge and behaviour in Jordan	Journal of Environmental Education	Narrative case study	3–12 years	Libraries in Jordan	3 months
15	Malberg & Wistoft (2018)	Wellbeing in school gardens – the case of the Gardens for Bellies food and environmental education program	Environmental Education Research	Mixed method – case study design	K – 8th grade	Denmark school gardens	Variable
16	Perrin (2018)	Recognizing connection to nature: Perspectives from the field	Applied EE and Communication	Semi-structured interviews	EE practitioners	EE programmes across 6 states in the US	N/A
17	Randler et al. (2005)	Cognitive and emotional evaluation of an amphibian conservation program for elementary school students	Journal of Environmental Education	Quasi-experimental approach	Grades 3 and 4 (9–11 years)	Indoor/outdoor education programme, Germany	Pre-, post-test (after 1 week) and retention effect (after 4–5 weeks)
18	Stern et al. (2014)	Environmental education program evaluation in the new millennium: what do we measure and what have we learned?	Environmental Education Research	Systematic Literature review	Youth 18 years & under	N/A	N/A
19	Sutherland (2017)	Conservation education in schools: Aligning teachers' perceptions with students' attitudes	Applied EE and Communication	Survey	High school students	Kansas school	N/A

4.2 Evaluating environmental educational programmes

Even though the Cape to City education programme is not typically an EE programme, there are some connections and positive influences that are relevant to this review. Stern et al. (2014) found broad evidence that EE programmes can lead to positive changes in student knowledge, awareness, skills, attention, intentions, and behaviour. However, only circumstantial evidence was found which related to how or why these programs produce these results. The authors provided an overview of effective EE practices that positively influenced outcomes of EE programmes:

1 Active and experiential engagement in real-world environmental problems; including issue based, project based and investigation-focused programs in real world nature settings.

2 Empowerment and student-centred learning leading to the development of self-efficacy skills and perceptions.

3 Social engagement, e.g. cooperative group work amongst students and inter-generational communications and teacher engagement.

4 Teachers and other adults as important role models in developing environmental literacy. Teachers could develop their own experiential learnings which they passed on to students.

5 EE instructor style was a primary driver of positive outcomes for students including passion for the subject matter and genuine care and concern for students.

6 Emotional connections, e.g. interactions with animals and places, extensive group discussion and collaboration involving the communities and real world problems.

7 Consensus-based best practices, such as those published in the North American Association for Environmental Education's Guidelines for Excellence.

8 Holistic experiences, i.e. conveying a complete idea or story within the educational context which should involve pre-experience preparation and post-experience follow up.

9 Other successful programs focused on specific places and issues which link program content to students' home lives, and/or provoke student reflection.

Overall, Stern et al. (2014) concluded that most current EE programmes did not isolate programme components so were only able to speculate about why a particular programme achieved its particular outcomes.

In contrast, Ardoin et al. (2018) found that the number of published articles that focused on measurable student outcomes in EE had increased steadily from 1994 to 2013, which he attributed to a change in United States education policy and an increasing emphasis on measurable outcomes in environmental conservation. Ardoin et al. (2018) noted that many EE programmes occur across a range of settings and in various configurations leading to positive outcomes in terms of environmental knowledge, dispositions (attitudes), competencies, and behaviours. In addition to the environment focused outcomes, EE programmes were also found to improve academic achievement and increase civic

engagement. The authors found that EE programmes were highly successful at meeting knowledge and competency outcomes but not quite as successful at measuring change in dispositions and behaviours because of their complexities. The review suggests that EE research should position itself across lifespan timeframes and look beyond immediate outputs and outcomes as only 29% of the reviewed studies included post-programme follow-up and these were mostly conducted within 6 months of the EE experience. In the studies covered in the review, EE is often more directly focused on relationships, processes, and providing opportunities for transformative experiences rather than focusing on a specific outcome.

Boeve-de Pauw and Van Petegem (2017) provide an empirical evaluation of their EE programme. The 'eco-schools project' is an international initiative that has been implemented in Flanders, Belgium, and encourages young people to engage with their environment by allowing them to actively protect it. The authors carried out a large-scale study of eco-schools, focusing on values, motivation, and knowledge as learning outcomes. They surveyed 2,152 students and 1,374 teachers in 101 primary and secondary schools actively involved in different stages in the eco-schools programme. Their results showed that students in eco-schools consistently know more about the environment than students in control schools. However, they found that the project didn't teach students applied knowledge and that students needed opportunities to transfer their theoretical knowledge into practices. There were benefits from having a 'green' school campus but they found that real educational impact is more achievable when nature is also used in the teaching and learning and not serving a purely decorative function. Three pillars of policy-making capacity were identified as being important in this study and include 'shared leadership', 'common goals', and 'supportive relations'. Schools where the teachers felt supported by their peers and school leader succeeded better in decreasing the utilisation values of their students.

Randler et al. (2005) evaluated cognitive and emotional wellbeing using pre-, post- (after 1 week) and retention (5 weeks after) tests to compare indoor and outdoor education programmes in Germany. The study reported a conservation action aimed at enhancing knowledge about amphibian species and the positive learning outcomes that resulted from the engagement. Students who participated in the conservation programme performed significantly better on learning achievement tests than their peers, who did not take part in the programme. This research also controlled for prior knowledge. Pupils engaged in the programme expressed high interest and well-being and low anger, anxiety, or boredom. The research suggests that teaching students about biodiversity programmes should start in primary schools; take place outdoors; be linked with classroom teaching; and focus on a small number of species.

4.3 Building positive environmental awareness and engagement

There are a range of ways to build positive environmental awareness and engagement with students. This section identifies four diverse learning methods from the literature: Education in the outdoors, garden-based learning, community reading programme & stories, and drama & puppetry.

4.3.1 Education in the outdoors

The direct benefits of taking students outdoors is communicated in the findings of several journals articles in this review. Outdoor education[3] engagement in this literature review was manifested in many forms from one-day programmes to week-long camps, and occurred in natural settings, green classrooms or school gardens.

Outdoor environmental education programmes, structurally detached from typical school lessons, and with appropriate hands-on activities can produce a significant increase in student environmental knowledge, attitudes and behaviour (Dieser & Bogner 2016). In Dieser and Bogner (2016), students attended a week-long outdoor education programme in the Bavarian Forest National Park. They were tested pre-, post- and 6 weeks after the EE programme and benefits of the camp were sustained over the 6-week period. The students showed an increase in forest knowledge, and through role play games and observation of animals in their natural enclosure environment, knowledge about wolf and lynx and their relationships to real life situations became more vivid. Follow-up activities of producing a poster or board game contributed to students retaining knowledge and were strongly correlated with well-being factors. The study also recommended multiple visits to the same natural site because when students become familiar and comfortable in a specific environment, they found it easier to concentrate and acquire new knowledge.

Beery and Jørgensen (2018) investigated childhood nature engagement, play, and exploration as key components in generating environmental understanding. Children's play and exploration in and of the environment were also closely connected to ecological knowledge. These authors argue that raising biodiversity awareness and making biodiversity accessible to children is an essential component of current and future biodiversity conservation.

As identified in Sterne et al. (2014), a holistic experience positively influences EE outcomes – a key component of the Cape to City education programme. Teaching Green Buildings (TGBs) in the United States have been designed and built to engage students with the concept of sustainability and offer unique opportunities for holistic environmental learning experiences (Cole & Alterburger 2017). These schools offer natural laboratories for studying the intersection of green buildings and EE. Cole and Alterburger (2017) carried out a mixed methods study using a survey, focus groups, and interviews with key adult informants to understand how the school facility design, culture, curriculum, and teachers as role models provided multiple channels for EE. They found that students from all three schools investigated had basic green building knowledge and environmentally responsible behaviours. However, two of the schools, despite access to TGBs, were not communicating sustainability through diverse channels and the EE outcomes for their students were

[3] In the NZ Curriculum, Outdoor Education, is defined under "Health and PE" as providing students with opportunities to develop personal and social skills, to become active, safe, and skilled in the outdoors, and to protect and care for the environment (see http://health.tki.org.nz/Teaching-in-HPE/Health-and-PE-in-the-NZC/Health-and-PE-in-the-NZC-1999/Key-areas-of-learning/Outdoor-Education). Although much of the Cape to City Education programme is delivered outdoors, it isn't 'Outdoor Education' and would more accurately be called Education in the Outdoors.

disjointed. The school with the most established TGBs offered numerous ways for students to engage with the TGB and this resulted in a more holistic and connected understanding of green building within the larger ecological context. The authors argue that green buildings can amplify pro-environmental policies and practices and transform schools from places that are 'just kind of normal' into extraordinary incubators for sustainability culture.

4.3.2 Garden-based learning

School gardens as settings for outdoor learning are popular worldwide and studies have shown that they can increase willingness among children to try new foods; increase preferences for fruits and vegetables; connect children to nature; and enhance their understanding of and motivation for studying natural science (Malberg Dyg & Wistoft 2018).

The 'Gardens for Bellies' Danish school garden program operates in urban and rural settings across Denmark. The research carried out by Malberg Dyg & Wistoft (2018) involved field observations in five school gardens in Copenhagen, Denmark, that were engaging with EE programmes. The study carried out focus groups and in-depth interviews with school students from kindergarten to eighth grade (age 13); and interviews with garden educators, and teachers. In all schools the students expressed positive emotions about their garden experience. These positive emotions were linked with a sense of freedom and happiness at being outdoors and learning in a natural environment; spending time with their peers; and learning from inspired garden educators. Teachers and garden educators also reported that the outdoor education promoted student well-being in a social environment that encouraged cooperation among students, strengthened their relationships with one another, and enabled them to handle conflict better. The outdoor environment also challenged established roles and learning through discovery. Teachers and garden educators reported that students learnt to connect with and see themselves as part of nature and their academic learning and personal well-being was enhanced. Parents also reported that their child's well-being, self-esteem. and interpersonal relations improved.

Scott Kozak and McCreight (2013) examined the development of school gardens in United States primary schools and the resulting positive learning impacts on students engaged with the project. In this study, students increased their environmental knowledge, problem-solving abilities, decision-making skills, and connection to nature through the development and implementation of a student-led school garden. The students collaborated with teachers, families, and the local community. Teachers reported that students gained a sense of land stewardship through engaging with their school garden. The research suggests that to strengthen this connection, children should plan, construct, and cultivate the garden from the very beginning rather than walking into a ready-made garden environment. They also report that students engaged in EE programmes perform better on standardised exams, have a greater interest in learning, and greater self-esteem about their ability to learn when compared to their peers not engaged in such programmes. These students were invested in the success of their garden because it was their idea. This study highlights the importance of family and school connections; community partnerships and students engaging directly with the environment.

Lebo and Eames (2015) examined food, science, and sustainability education in a New Zealand context. The research used permaculture design thinking to create a science and sustainability education intervention for a secondary school science class. They hypothesise that just as food nourishes living beings, the context of growing food has the potential to nourish science and sustainability learning. The aim was to cultivate an environment that engaged both students and teachers. Data from the student learning experiences supported the cultivation of positive attitudes towards science and sustainability. Garden-based learning was identified as providing real contexts that allowed valuable opportunities for knowledge construction, higher order thinking and the development of analytical and synthesis skills. Student engagement at the permaculture site consolidated classroom learning with hands-on engagement and increased student knowledge of their local communities, and the importance of sustainability and how to practise it in relation to growing food. On reflection, the teacher emphasised the benefits of field trips to make the science relevant. The use of permaculture as a teaching medium created multiple learning outcomes in ecological design, science education, and sustainability practices.

4.3.3 Community reading programme and stories

Mahasneh et al. (2017) utilised a "We love reading program" in communities in Jordan to address environmental problems. Twelve fiction and non-fiction social stories addressing local environmental issues were written in Arabic on water use, energy, and littering. Informative drawings for colouring and relevant conservation activities that could be performed at home or in their community were designed. One hundred trained adult volunteers read the stories to children in libraries throughout Jordan once a week for 3 months. Pre- and post-reading assessments were conducted using knowledge worksheets and the children's parents were given a checklist to measure behaviour change. There was a significant difference in children's knowledge before and after the intervention. The greatest effects of the intervention were with children aged 3–6 years compared with children aged 7–9 years or 10–12 years. The authors suggested that Jordanian schools should integrate EE content into their existing curricula and involve the community to have a long-term positive effect on students' environmental behaviours.

The Cape to City education programme encourages local people or mana whenua to share stories of "Their Place" with the students to help them make personal and ancestral connections between the land and themselves so that they will develop a capacity to care and make connections with the local community.

4.3.4 Drama and puppetry

Incorporating the creative arts into EE programmes is a relatively new practice but in New South Wales, Australia, the drama curriculum provides opportunities for the environment to be studied through performative studies. Curtis et al. (2014) used case study analysis to explore the utilisation of drama in EE. Three theatre performance are used – theatre-in-education (demonstration theatre), play-building, and a large-scale performance event – to positively influence students about the environment. They conclude that drama provides 1) a means of synthesising and presenting scientific information in creative and multi-layered ways which excite students and keep them emotionally engaged; 2) creates

fertile conditions for later engagement with environmental topics presented in a more traditional manner; 3) combines all learning styles and allows deep learning to take place; and 4) can be easily integrated with other activities to enrich educational experiences. This case study research provided evidence that a performance-based EE programme can influence beliefs and attitudes towards the environment and enable students to adopt pro-environmental behaviour, e.g. one case study led to significant reductions in water and energy consumption among children and their families after they had watched environmental theatre.

Appleby (2005) used puppetry and drama with year 5 students from Brisbane, Australia, to collaboratively develop an environmental education unit. The collaborative planning and reflection was between an experienced classroom teacher and a drama/environmental educator and researcher. They used sustainability education as their critical lens. In the middle primary years, children are seeking to understand and create meaning from the culture in which they are immersed. This development stage is important in developing values and beliefs that contribute to individuals' emerging life narratives, which in turn inform decision-making and ethical judgements. Therefore, this is an opportune time to engage children of this age with an eco-connected curriculum. Developing the drama pedagogy was not only a catalyst for understanding complex and deep levels of meaning for the classroom teacher, but also prompted discussion about other important issues such as quality of student engagement, classroom power dynamics and authentic ways to assess students. The researcher reports that students developed deeper subject understanding and meaning generated through role-play and writing from a perspective that was not necessarily their own.

4.4 Connectedness to Nature

According to Braun and Dierkes (2017), nature connectedness is a crucial predictor of pro-environmental behaviour. Childhood experiences and engagement with nature are thought to be particularly significant in developing these connections. Research conducted by Braun and Dierkes (2017) highlights a need for early age nature experiences and the benefits of outdoor education in developing this bond with nature. They found that when students from primary and secondary schools (7–18 years) in Singapore have a direct experience with the natural environment this can restructure their connection with nature. Furthermore, the study confirms the positive benefits of learning experiences in authentic natural surroundings compared to ordinary school lessons covering the same topics.

Perrin (2018) carried out semi-structured interviews with EE practitioners from six states across the United States to better understand how they define and measure connectedness to nature. The findings suggest that a child who is connected to nature feels an emotional attachment and develops a strong conservation ethic. Participants reported that engaging with students outside in the natural world is critical to them 'falling in love with nature', realising its value, and developing their desire to want to protect and conserve it. Furthermore, building a relationship between environmental knowledge – capturing its wonder and complexity – and conservation behaviour is viewed as being critically important. Standardisation of outcome classifications is identified by the

practitioners as necessary because often the programmes cannot be evaluated because there are not clearly defined, measurable and agreed upon objectives. Collaboration and resource sharing of connection to nature-oriented measurement tools was identified as the best way for the field to do this.

Finally, results from a paper by Hughes et al. (2018), published after the literature review was carried out, conclude that while measuring and defining the connection to nature is subjective, the Connection to Nature Index (CNI) is the best indicator of students demonstrating conservation behaviour. The CNI provides an evidence based approach to measuring children's connection with nature. See Cheng and Munroe (2012) for further information on the CNI.

4.5 Community links

An Australian study examines the links between schools and their communities in fostering a strong culture of EE to tackle issues of sustainability and climate change (Flowers & Chodkiewicz 2009). The study found that efforts to support and develop EE programmes where schools work with and in communities was limited and only modestly funded. They concluded that there was a need to refocus government effects on the positive and central role that local community-school partnerships can play in achieving more transformative environmental change. They recommend that local councils are key important organisations for leading community-school links as community-school partnerships can increase the support, reach, and impact of EE programmes.

A Chinese based study examined the value of engaging primary school students in an environmental education initiative in the Caohai nature reserve (CNR) where the black-necked crane is threatened with extinction from habitat loss and land use changes (Chan et al. 2017). There are tensions between human (agriculture) and wildlife needs for the natural resources in this region. Integrated Conservation and Development Projects were set up and an international nongovernmental organisation (INGO) worked in partnership with local communities to conserve the natural resources. EE was part of this programme; however, the educational system in China is highly exam-oriented and therefore it is difficult to integrate the EE curriculum into schools. The Caohai case is the exception and EE has been running in local primary schools for over 15 years due to building strong social capital between farmers, INGOs, and the CNR. The programme has helped alleviate poverty in the local primary schools by improving infrastructure, awarding scholarships, and developing teacher workshops and summer camps oriented to outdoor education. While building trusted relationships in the community has been instrumental in developing EE programme for the primary schools, the authors conclude that EE needs to be supported and recognised by the Chinese educational system and local government for it to be integrated into the regular curriculum.

4.6 Engaging with environmental issues

Globally there is a push to educate young people about environmental issues such as climate change, air and water pollution, habitat destruction and biodiversity loss. Teachers play a key role in educating students about the environment, conservation and

sustainability practices across all grade levels. Sutherland (2017) surveyed students' attitudes and teachers' perceptions in elementary, middle and high schools from Kansas. High school students were identified by the teachers as being the least receptive to EE. However, the student survey results showed that high school students do think learning about the environment is important and that a variety of interactive, participatory methods with real-life meaning should be used to teach conservation education. According to the student survey findings, teachers are more influential than parents when it comes to helping students develop environmental literacy and make positive environmental choices. Effective conservation education can be instrumental in educating students on how to address current and future environmental issues. The researchers suggest that EE should be delivered across the curricula for greatest impact and students who are especially interested in conservation should be offered opportunities to share their knowledge with their community through extracurricular opportunities or a specialised class.

In a comparative study, Aguirre-Bielschowsky et al. (2012) investigated Mexican and New Zealand children's perceptions of the environment and their understandings of environmental issues. The study focused on primary school children (aged 9–11 years) from three schools in Dunedin, New Zealand, and three schools in Ensenada, Mexico. The research suggests that children's understandings of the environment are connected to their personal experiences and are mediated by their culture. In both countries, children from schools with an EE programme translated environmental practices learnt at school into environmental practices at home. Students in Ensenada had a more global perspective on environmental issues than students from Dunedin; however, these Mexican students displayed a more passive attitude towards their local environment and participated in fewer environmental activities compared to their Dunedin peers. The study also reports that EE approaches that consider children as active learners and encourage critical thinking increase children's emotional bond with nature, increase learning motivation, and create more environmentally conscious and active students.

4.7 Summary

The 19 journal articles considered in this literature review endorse the benefits of environmental education for students and link to aspects of the Cape to City education programme. While EE programmes have been shown to improve student academic achievement, build positive environmental awareness & engagement, create healthy environmental attitudes, and increase environmental actions, few studies attempted to empirically isolate the characteristics of the programme to measure outcomes. However, the review does provide insights into how EE programmes can build student resilience and well-being by lowering anxiety, reducing boredom, and increasing their engagement at school. Key learning skills such as critical thinking, problem solving, decision making and team building also have benefits for future learning and applying these programmes in an outdoor setting will assist with connections to nature. The positive impacts of EE can be enhanced through cross-curricular engagement, the use of school gardens or other natural outdoor habitats, the use of drama, storytelling, engagement with green buildings, framing through conservation, and the creation of a holistic experience that conveys a complete idea or story within an educational context.

5 Cape to City Education Programme Outcomes

5.1 Introduction

The Cape to City project is a collaborative ecological restoration project in Te Matau a Māui/Hawke's Bay. The Cape to City education programme is focused on inspiring young people and future decision-makers of New Zealand. The education team runs four education programmes: Backyard Biodiversity, Marine, Bush, and Freshwater environments. Seventeen schools are currently involved in these education programmes. These schools and their locations are shown in Figures 1 and 2. The teachers involved with the Cape to City education programme are not EE focused teachers but mainstream teachers who expressed an interest in participating in the Cape to City education programme.

Figure 1 The 17 schools who participated in the Cape to City education Programme.

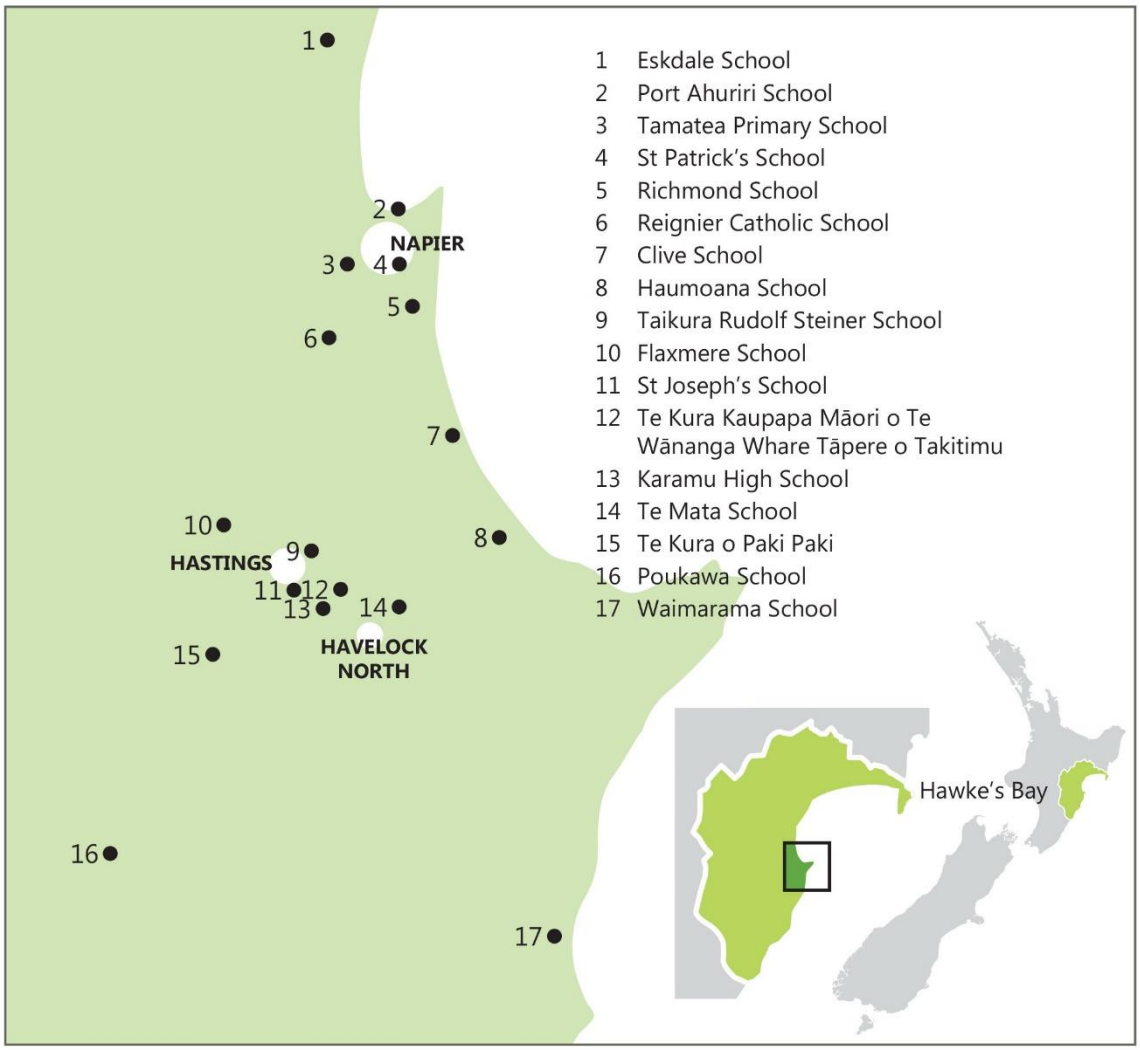

Figure 2 Location of Cape to City education programme schools in Te Matau a Māui/Hawke's Bay.

This section outlines key components of the Cape to City education programme that have enabled the programme to thrive. These include: an inquiry-based learning strategy, outdoor workshops, partnerships, the weaving of environmental knowledge into the whole school curriculum, and real school examples of where the programmes have been applied.

5.2 Inquiry-based learning

Teaching strategies that actively engage students in the learning process through scientific investigations are more likely to increase conceptual understanding than more passive strategies (Minner et al. 2009). Inquiry-based learning is student-led, and is based on earlier learning and experiences, natural curiosity and questions, and student interests. Therefore, students engaging with the Cape to City education programme follow an inquiry-based learning approach. An important component of the inquiry process is 'taking action' and, in Cape to City terms, this means action 'for' the environment. For example, students of Te Mata Primary School were involved in learning about a 'voyaging waka' as part of the marine Cape to City education programme (Fig. 3).

Figure 3 Te Mata Primary School, marine Cape to City education programme – voyaging waka, Te Matau a Māui.

The inquiry-based learning journey for students participating in the Cape to City programme is based on a model consisting of seven components: Aspirations, understanding, skills, convenient systems, trusted others, change moments, and reinforcement (Fig. 4). The model begins with the aspirations, i.e. the visions that connect the project goals to people's hope, dreams and identities; and then leads to: understanding the rationale of the project; the range of skills and experiences that are possible; the design, delivery and management of systems and programmes that will guide the projects; the connections and trust between the leaders, endorsers and peer educators; and the change moments, life experiences and places where new connections are made and comfort zones are safely challenged, resulting in the reinforcement that real benefits have been achieved.

These seven components underpin three Cape to City education programme delivery strands comprising:

1 An education partnership with the Eastern Institute of Technology (EIT) Hawke's Bay

2 A long-term Cape to City education programme with schools

3 Whole-staff outdoor-learning workshops with schools

The three strands complement each other and provide platforms for working alongside trainee, early-career and established teachers; involving whānau and communities through schools; and providing opportunities to partner with local and national agencies to achieve mutual goals.

The overarching Cape to City education programme aims are for students and teachers to develop an in-depth understanding and appreciation of their local environment.

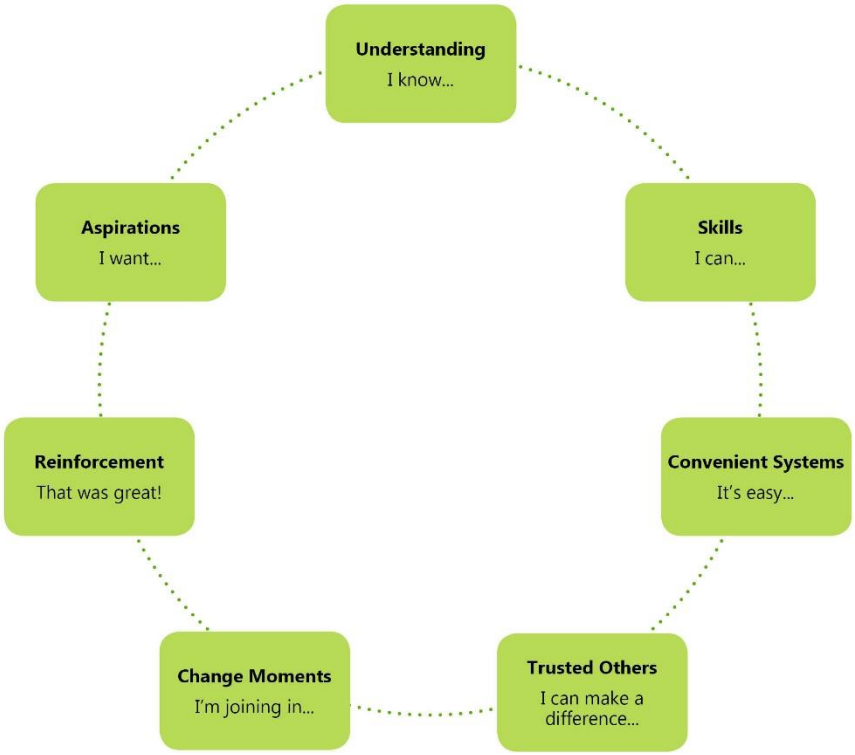

Figure 4 Model for increasing involvement of schools in the Cape to City learning journey (Adapted from Les Robinson's "Seven Doors: Elements of a Community change programme." Social Change Media, Australia, 2001).

Programme participants build an understanding of their local ecosystems and their contributions to human survival, therefore learning to identify factors that threaten them. Students become teachers themselves, sharing their learning with peers and whānau, and taking charge to decide collectively upon and carry out actions helping to protect and enhance their environment.

The Cape to City education programme consists of four well-established, fully curriculum-linked programmes, running in schools over 1–2 terms. The programmes are: Marine; Freshwater; Bush Education; and Backyard Biodiversity, and have the following features:

- A planning phase with teachers to ensure that the programme is fully integrated with teacher learning intentions and curriculum objectives
- A flexible programme capacity to cater for single class or whole school engagement
- Inquiry based learning developed within the context of a class or school.
- Enhanced student learning using timetabled modules facilitated by Cape to City education programme delivery staff, their agency partners, and local experts from within the school's community
- Modules typically include in-school activities and local field trips
- Regular revision of the programme content and delivery with teachers and partners ensures their ongoing relevance and quality
- A self-chosen action to complete the programme (see Section 5.7).

The Cape to City education programme relies on the environmental beliefs and attitudes of its teachers, and developing those values is an integral part of the teacher training journey. Cape to City supports this practice through their partnership with EIT Hawke's Bay, where they are working with Primary and Early Childhood Education lecturers, and their developing teachers. Teachers also need to understand and be able to communicate core environmental concepts such as biodiversity to their students. This programme helps teachers and students appreciate New Zealand's unique native species and the ecosystems in which they live and builds understanding that many of these species are endemic to New Zealand and therefore are taonga. In the education programme, teachers and students also learn about biosecurity and familiarise themselves with pest species and pest control techniques such as trapping. This enables the participants to see the "big picture" or get a more holistic view of the often-unseen, long-term consequences of human choices and actions.

5.3 Outdoor workshops

The Cape to City education programme provides teachers with tools to enable their students to lead their learning journeys. The education facilitators support this inquiry-based approach by holding 'whole-staff' outdoor workshops in schools. These workshops resulted from teacher feedback where the importance of collegial support when working to embed new ideas and methods within a school's culture and classroom practice was highlighted.

The approach is a catalyst for teachers to start thinking and talking about the kind of outdoor learning spaces they might like to develop and use with their students. During the workshops, the facilitators help the participants to define the school's culture and to develop aims and learning goals which can be measured and reviewed later. The staff are encouraged to reimagine the school grounds as a treasure trove of learning opportunities which are applicable for learners working at all levels. The workshop enables teachers' concerns to be addressed by sharing practical ways to overcome perceived barriers. It is also an opportunity to share up-to-date resources and networks to facilitate and extend outdoor learning.

A spinoff from the workshops has been the development of a hands-on, locally relevant, NCEA (New Zealand National Certificate of Educational Achievement) Assessment Unit championed by Andrea Roberts, a biology teacher from Karamu High School. Andrea participated in the inaugural teacher workshop and with the help of Cape to City facilitators and Department of Conservation staff she accessed research material, gained approval for her proposed field research methodology, and negotiated the permission and consultation processes for the assessment unit. The unit enables students to gain NCEA credits by undertaking and presenting research projects on nest distribution at the Cape Kidnapper's gannet breeding colony during the birds' absence. The project generated new research findings by documenting an aspect of gannet behaviour at the Cape that had not previously been recorded. The pilot trial reported overwhelmingly positive levels of engagement and achievement from all the students involved. The students also reported a strong sense of pride and ownership because of their involvement in the project, which they also shared with their whānau. The projects' success has continued to grow since its

inception, with student presentations on the project winning the senior section of the National Science Fair in 2017, and one student winning a scholarship to travel and present her research findings at the 2018 International Science Fair in Taiwan.

5.4 Partnership building

A key component of the Cape to City education programme has been the partnerships developed between the local agencies. Of the five, individual partner organisations that comprise Cape to City, three of these – DOC, Cape Sanctuary, and the Hawke's Bay Regional Council – are all hands-on partners in the education programmes. In May 2017, Cape to City also signed a Memorandum of Understanding with the Eastern Institute of Technology (EIT). The Programme also partners with the National Aquarium in Napier and the Ministry for Primary Industries, Fish & Game NZ, and Dolbel Reserve Volunteers' Group.

To ensure continued learning and positive practical outcomes for the environment are maintained long term, the education facilitators acknowledge the value of building networks and relationships between schools and the partner agencies. In addition to working with their delivery partners, Cape to City facilitators actively seek out and collaborate with people working professionally in biosecurity and conservation to ensure their work and methods reflect current best-practice. For example, Cape to City education facilitators are active participants in their local Environmental Education Forum and contribute to regular Skype meetings of Collaborative Community Project coordinators from around the country.

Local reserve volunteers and whānau are an integral part of the education programme. Reserve volunteers have the capacity to engage and inspire school students (Fig. 5) and parents and whānau can provide support by sharing their knowledge or whakapapa links with the local area.

Figure 5 A volunteer showing students from St. Joseph's Primary School Hastings how to plant a tree in Dolbel Reserve (Source: Cape to City facilitator).

5.5 Weaving environmental education into the whole school curriculum

The Cape to City education programme aims to weave environmental principles across the entire school curriculum. The environment offers rich and authentic contexts for learning and a way to connect people of all cultures, abilities and interests. Champion teachers are encouraged to use these authentic contexts with the help of Cape to City facilitators to make meaningful environmental links across the entire curriculum.

The literature review in Section 4 highlights the diverse ways in which environmental learning can be implemented across the school curriculum. After engaging with the Cape to City education programme, the Hawke's Bay schools have applied their environmental knowledge across the curriculum to mathematics and statistics, art and drama, reading and writing skills, and technology. The following examples are drawn from student and teacher engagement within the Cape to City education programme.

5.5.1 Applications in mathematics and statistics

Collecting real life data from local ecosystems enables students to make connections between mathematics & statistics and the environment. Increasing students' understanding and thinking about environmental issues can lead to better ideas about what actions need to be undertaken. For example, after a fieldtrip to Cape Sanctuary, students from Te Mata School played a dice game involving responsibility for a sanctuary. They had to determine how many different species were in their sanctuary, threats to their habitats, and the potential for endemic animals to thrive. The data generated were interpreted and the results were presented in a meaningful way to show what action was needed (Fig. 6).

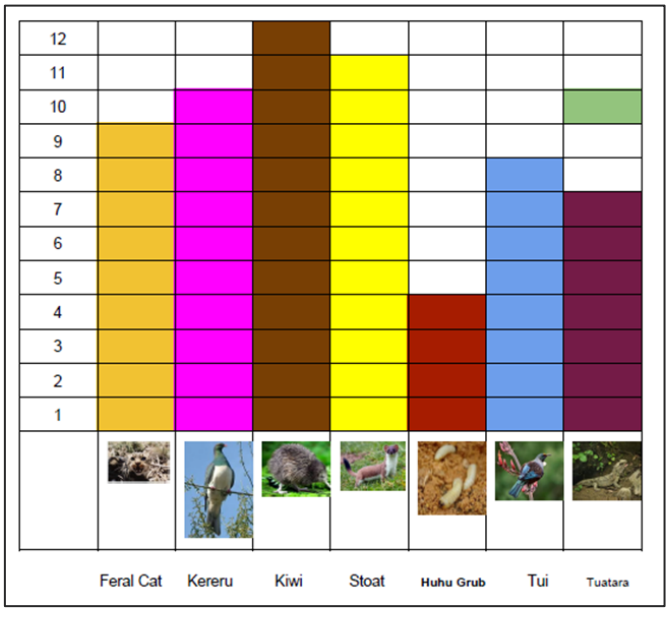

Figure 6 An example of how data were presented by a Te Mata student participating in the Backyard Biodiversity Programme.

5.5.2 Art and drama

Engaging with the environment provides a powerful inspiration for artistic creations. The Backyard Biodiversity programme provided opportunities for students to create their own artworks (Fig. 7).

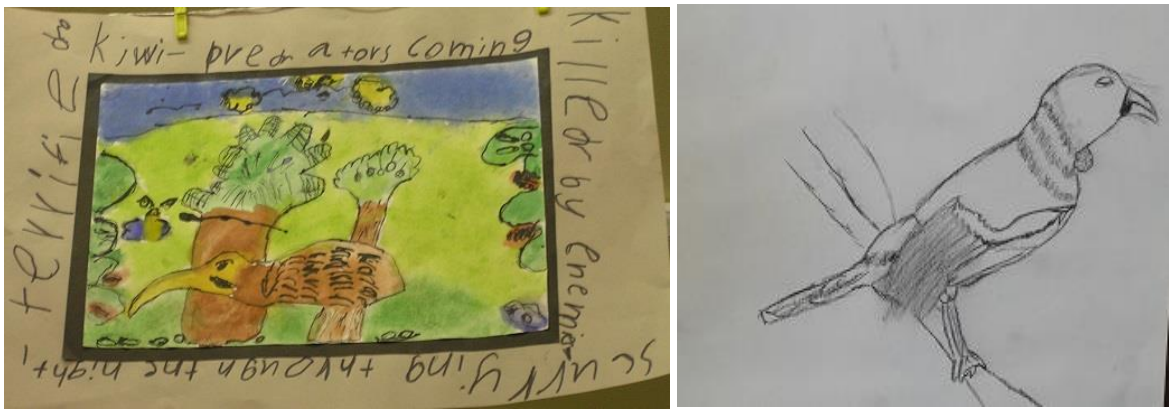

Figure 7 Artworks by students from Haumoana Primary School (left) and Te Mata Primary School (right). Students participated in the Backyard Biodiversity programme.

5.5.3 Reading and writing skills

Student reading and writing skills can also be developed though engagement with the natural world and presented or communicated in different ways (Fig. 8).

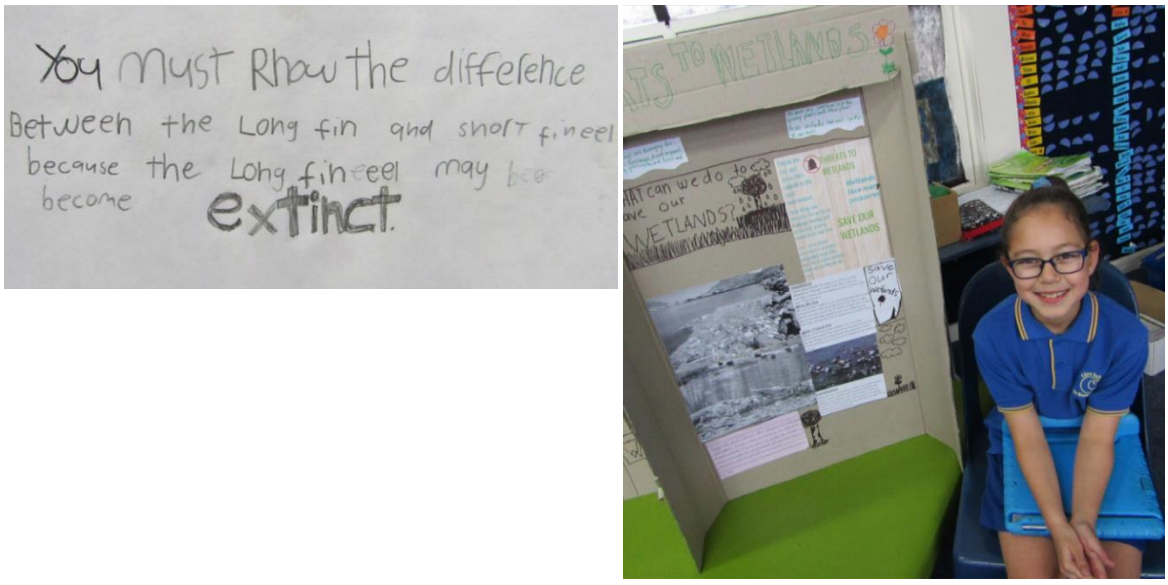

Figure 8 Student writing from Clive School Backyard Biodiversity programme (left) and a student's presentation of "Threats to Wetlands" Clive School Freshwater Programme (right) (Source: teachers).

5.5.4 Drama and the arts

The environment also provides inspiration for drama and the arts. In Figure 9 students from Clive School who participated in the Freshwater Programme acted out the lifecycle of an eel, which helped them to personalise the learning for these students.

Figure 9 Clive School students acting out the lifecycle of an eel (Source: Cape to City facilitators).

5.5.5 Technology

Technology is another curriculum area where engagement with the natural environment can be applied to real world situations. For example, students from Te Mata Primary School designed a new type of tracking tunnel and students from Saint Patrick's School learnt how to use telemetry equipment to track a kiwi (Fig. 10).

Figure 10 A tracking tunnel designed by students from Te Mata Primary school (left) and students from St Patrick's School using telemetry equipment to track a kiwi at Cape Sanctuary (Source: Cape to City facilitators) (right).

5.6 Student actions

The final "formal" stage in the Cape to City education programme is for a student-led environmental action to be implemented. Student-led investigations and discussions in an authentic context enable them to become more engaged and better advocates for their environment. It also enables teachers to step back and reflect on student learning processes and can lead to deeper understanding of environmental issues by both the teacher and the students. In addition, schools frequently keep expanding their learning by drawing on community expertise, and knowledge or support provided by Cape to City facilitators.

A wide range of actions were undertaken by students from the seventeen schools involved in the Programmes. These are outlined in the next three sections.

5.6.1 Bush

Senior students from Tamatea Primary School participated in the Bush Education programme and learnt about the healing properties of native plants on their visit to White Pine Bush. As a result, two of the students carried out research on the healing properties of the kawakawa; producing a booklet and making kawakawa ointment (Fig. 11). These students then shared what they had learnt with younger children at the school and the booklet of remedies was used to advise a younger student which plant could help his eczema. This is an example of the students applying their knowledge of the healing properties of native plants to a real-life situation.

Figure 11 Kawakawa ointment made by students from Tamatea Primary School (Source: teacher).

Flexibility and inquiry-based learning enables schools to engage with a wide range of actions. Haumoana School used participation in the Bush Education Programme to motivate students to carry out several different initiatives:

- Students potted up self-sown native seedlings from leaf litter in the school garden for regeneration and sale at the school gala.
- Students hosted a class from another school to share new environmental learnings with them.
- The teachers and students created an impressive large wall display documenting their engagement with the Native Bush Education programme (Fig. 12).
- A father of one of the school children involved in the programme planted a paddock behind his house to create a native habitat for birds.

Figure 12 A wall display documenting Haumoana School's engagement with the Native Bush Education programme.

Te Mata School students carried out a range of initiatives in response to participating in the Bush Education programmes (Fig. 13).

- Students raised money by selling their school garden produce and used the proceeds to 'sponsor' a predator trap-line at Cape Sanctuary.
- Students created environmentally-themed outdoor games for all teachers to use with their classes.
- Students and teachers developed a back field in the school grounds into a green space with native planting and set up predator monitoring stations
- Students sent out flyers in their local neighbourhood to inform locals about how to provide safer habitats for native birds
- Students engaged with concepts of biodiversity and web of life by carrying out a Bioblitz at the school and communicating their understanding of these concepts through posters.


Figure 13 Student-designed predator monitoring device (left) and Bioblitz (right) (Source: teacher).

5.6.2 Backyard Biodiversity

In response to the Backyard Biodiversity Programme, the Taikura Rudolf Steiner School students and teachers collectively designed habitat development goals, e.g.

> *By the end of 2017 we will have created a water feature that doubles as a habitat for organisms that will live independently and expand on their own.*

To achieve their goal, they designed a biodiversity regeneration project plan and created a water feature that could also double as a habitat to boost biodiversity in their school grounds (Fig. 14). The teacher reported that the project fitted their learning focus and created learning opportunities across the whole curriculum. Students took complete ownership of building the water feature, with teachers and Cape to City partners becoming "side-line consultants". Two students built their own solar panel to power the pump for their water feature. The project created "a tangible and lasting taonga for the whole school to enjoy".

Figure 14 Biodiversity regeneration project plan (left) and the development of a school water feature created by students from Taikura Rudolf Steiner School (Source: Cape to City facilitator).

5.6.3 Freshwater

Waimarama School's main initiative was to team up with their local marae and the Hawke's Bay Regional Council (HBRC) to restore their local stream (Waingongoro Stream). They also developed a native planting space on the school grounds. A long-term goal is to create whitebait habitat in the Waingongoro Stream as it has been identified as a key whitebait spawning area.

Students and their teachers at Clive school carried out an independent wetland inquiry with the intention of determining what makes a good habitat for eels.

Te Kura o Pakipaki created a drama to help students communicate and engage with their Freshwater Education Programme (Fig. 15).

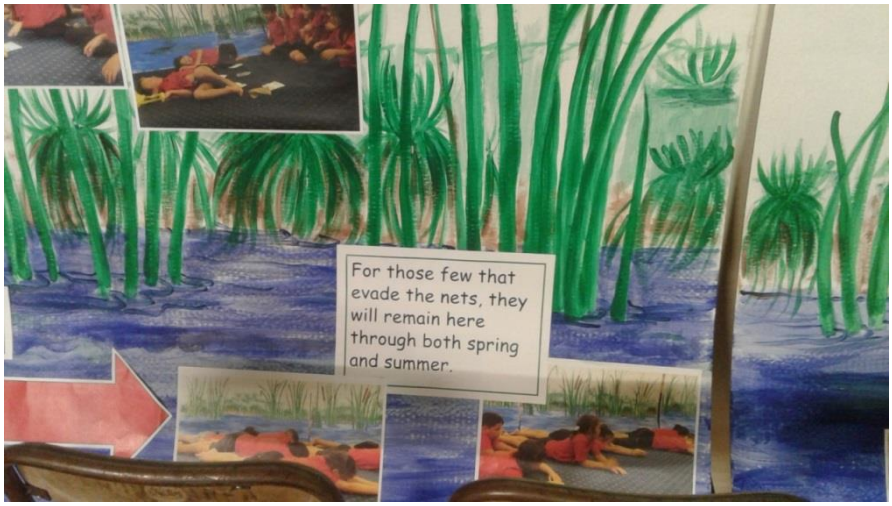

Figure 15 Visual display of Te Kura o Pakipaki drama for the freshwater education programme (Source: teacher).

They also created a number of research projects and presented their knowledge as research posters (Fig. 16).

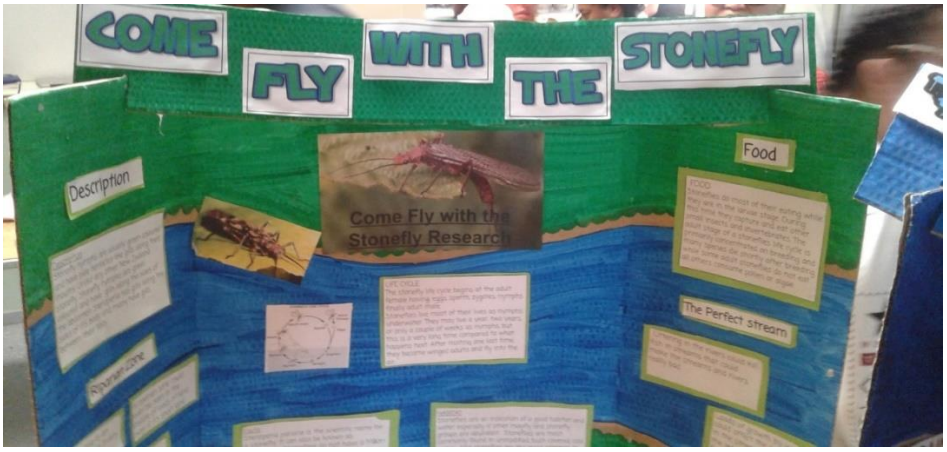

Figure 16 A stonefly research project by a student from Te Kura o Pakipaki School (Source: teacher).

5.7 Summary

Section five outlines the inquiry-based learning approach the Cape to City education programme uses to engage with teachers and students in Hawke's Bay. Key components of the Programme are conducting whole-staff outdoor workshops; building partnerships with schools, whānau, community groups, government agencies, and other organisations; and weaving the environmental programmes across the whole school curriculum by using art, drama, technology, mathematics and statistics to learn about the environment.

These examples of environmental actions are the result of the student-led inquiry learning approach taken by the Cape to City education programme facilitators. Champion teachers of the Programme have also designed a NCEA Assessment Unit; built partnerships with whānau, community groups, government agencies, and other organisations; enabled peer to peer learning; shared and embedded positive environmental values with students and their school community; and created school-based habitat creation projects, and pest monitoring and trapping projects.

The environment acts as a powerful cross-curricular source of inspiration for teachers and students and has enabled learning to be applied to real world examples, giving students the ability to communicate the complexities of the environment in a more holistic way.

6 Survey

6.1 Demographics

Unfortunately, the timing of the survey was not good for teachers participating in the Cape to City education programme, and this was reflected in the response rate. Eleven teachers involved in the Cape to City education programme (out of 48 requests – 22.9%) participated in the survey. Seven schools and the Hawke's Bay Eastern Institute of Technology (EIT) were represented. In contrast, from 20 requests, 18 respondents (90.0%), who had not participated in the Cape to City education programme (the "control"), completed the survey. Six schools were represented in this control sample. As a result of the small sample size, the following results are indicative only and therefore focus on overall impacts rather than on significant impacts of the education programme. Respondents who participated in the Cape to City education programme will be referred to as "Programme" respondents and those who didn't participate will be referred to as "Control" respondents. As the control and programme participants were not chosen randomly, i.e. they volunteered, this could also create a potential bias in the results.

The majority of respondents, both programme and control, had lived in the Hawke's Bay region for over 10 years; five had lived their whole life in Hawke's Bay. Four respondents participated in the Backyard Biodiversity Programme, four participated in the Freshwater Education programme, one in the Native Bush Education Programme, three in the Marine Education Programme, three in the Cape to City Teacher Workshop with Ruud Kleinpaste, and one in the EIT module with Cape to City educators as part of the Early Childhood or Primary Teacher training.

A high proportion of the survey respondents were female (81.8%) compared to the control respondents where only half were female. Most of the respondents were over 35 years; with only two of the respondents under 36 years (Fig. 17).

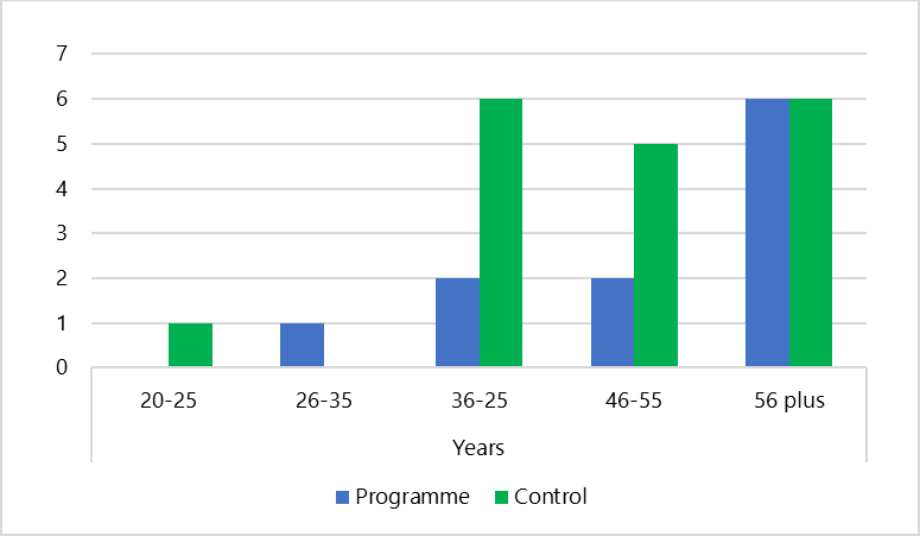

Figure 17 A frequency graph showing the age range of programme and control participants in the Cape to City education programme survey.

The remainder of this section summarises the findings from the two surveys. Where possible, the results are compared between the programme group and the control group. Topics include: Environmental beliefs and attitudes; Biodiversity knowledge and green space awareness; Environmental behaviour and action; Environmental practices embedded within school culture; Networking; Cross-curricular context; Barriers to change; Student engagement; Environmental digital resources; Environmental initiatives and organisations; and Cape to City education programme support.

6.2 Environmental beliefs and attitudes

Figures 18 and 19 summarise respondents' beliefs and attitudes about the environment using a 7 point Likert attitude scale from "strongly disagree" to "strongly agree". The environmental statements were selected to determine if there were any differences in attitudes and beliefs between the respondents participating in the Cape to City education programme and the teachers not involved in the programme (control). Please note the sample sizes are small.

Figure 18 indicates how the participants feel about the natural environment. There is general agreement between the control and the programme participants with all statements; however, apart from statement 4, the agreement or disagreement is stronger in the teachers participating in the education programmes. Participants generally **agree** that "The balance of nature is very delicate and easily upset (Statement 2)"; "The earth has limited room and resources (Statement 3)"; and "Plants and animals have as much right to exist as humans (Statement 5)". They generally **disagree** that "Maintaining economic growth is more important than protecting the natural environment (Statement 1)" and that "The balance of nature is strong enough to cope with the impacts of modern industrial nations (Statement 4)". Overall, both groups show pro-environmental attitudes.

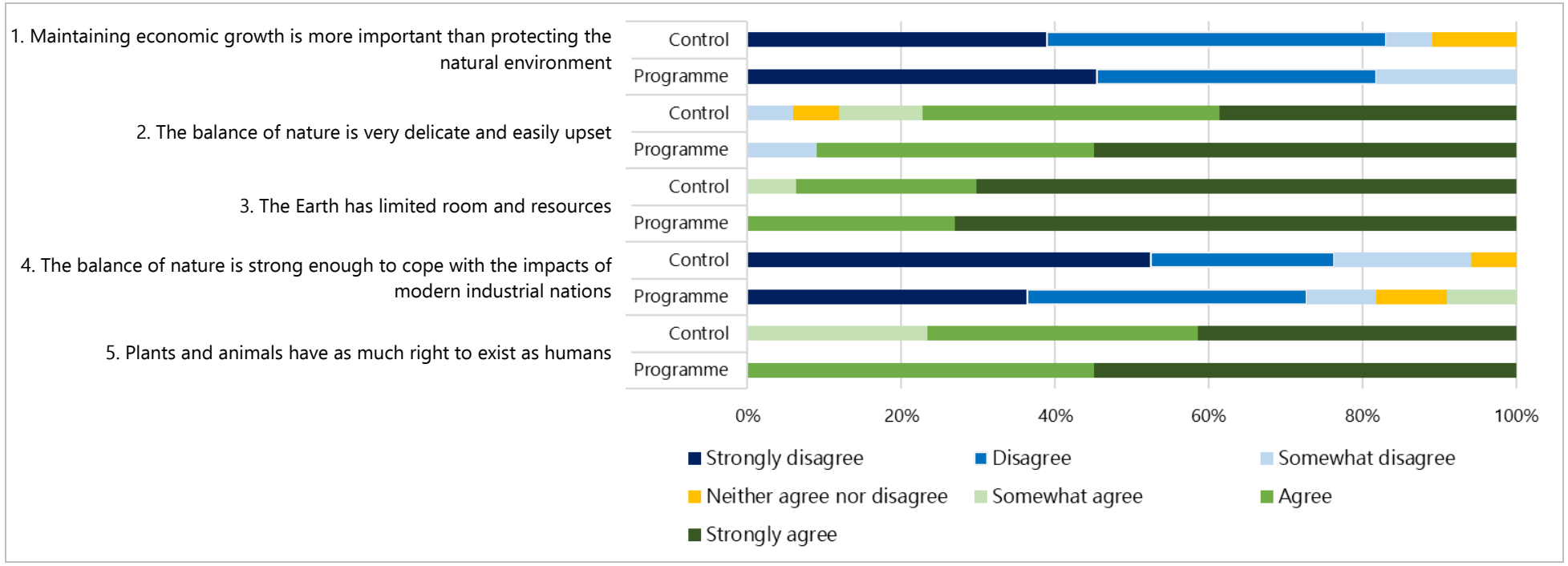

Figure 18 A summary of the attitudes and beliefs about the natural environment by respondents that were involved in the Cape to City education programme (Programme) and teachers who were not involved (Control).

The next series of statements asked participants about their perceptions of how well New Zealanders have cared for and protected the environment over the last 10 years and what they personally do to protect the environment in their community (Fig. 19). These statements give an indication of how likely participants are to take environmental action. Perceptions that New Zealanders are more aware of their environment and doing more to protect and enhance it than ten years ago are similar for both groups (Statements 6 & 7). Almost all participants agreed that one person can influence how environmental problems are resolved (Statement 8). Responses between the control and programme participants for statements 9 and 10 are mostly in agreement. However, the agreement is much stronger from the teachers who were involved with the Cape to City education programme. Both groups showed concern about their community environments and agreed overall individually they can do a lot to protect the environment in their community (statements 9 and 10).

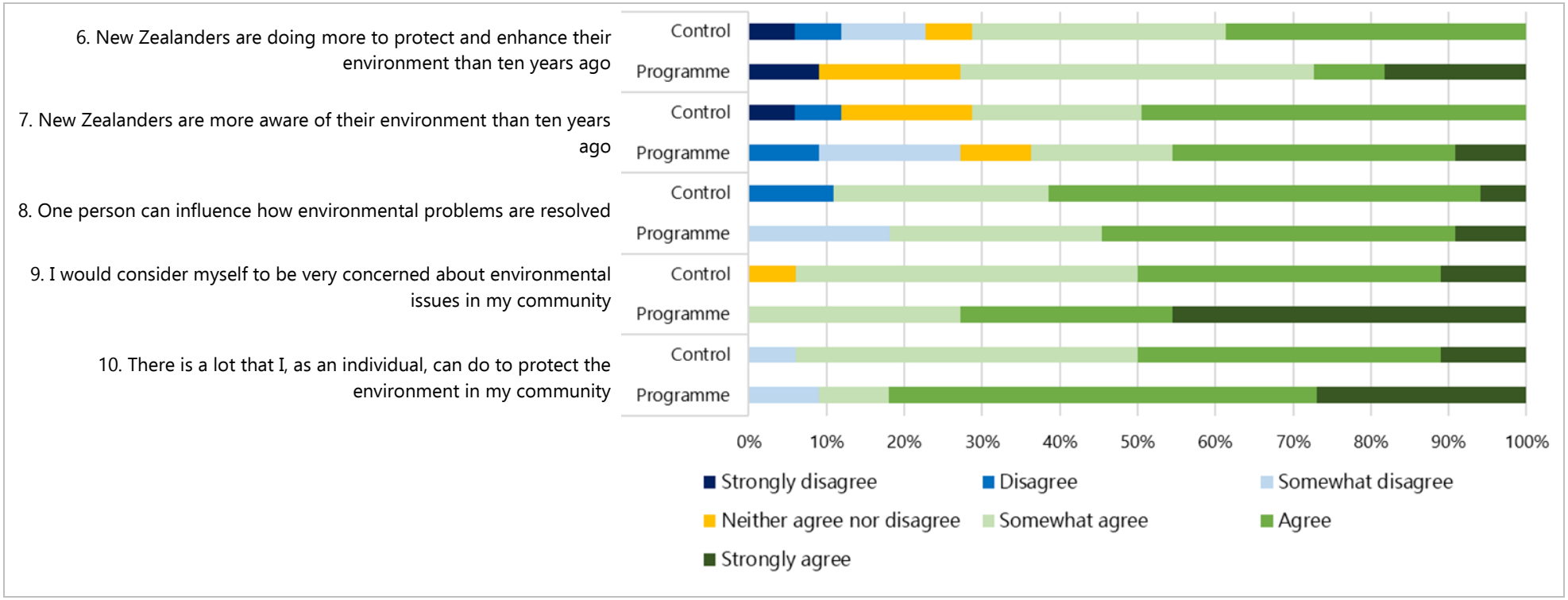

Figure 19 A summary of the attitudes and beliefs from a personal and national perspective by respondents that were involved in the Cape to City education programme (Programme) and teachers who were not involved (Control).

Three statements surveyed whether engaging with the natural environment is relevant and effective across the whole school curriculum (Fig. 20). Only ten participants involved in the Cape to City education programme answered this section. There was general agreement that learning in, about, and for the natural environment positively influences student achievement across the curriculum (Statement 11) and that students engage well when learning in, about and for the natural environment (Statement 12). However, one teacher in the control group was not sure and another teacher strongly disagreed with Statement 12. There is strong support for Statement 13 that the natural environment is relevant across the entire school curriculum.

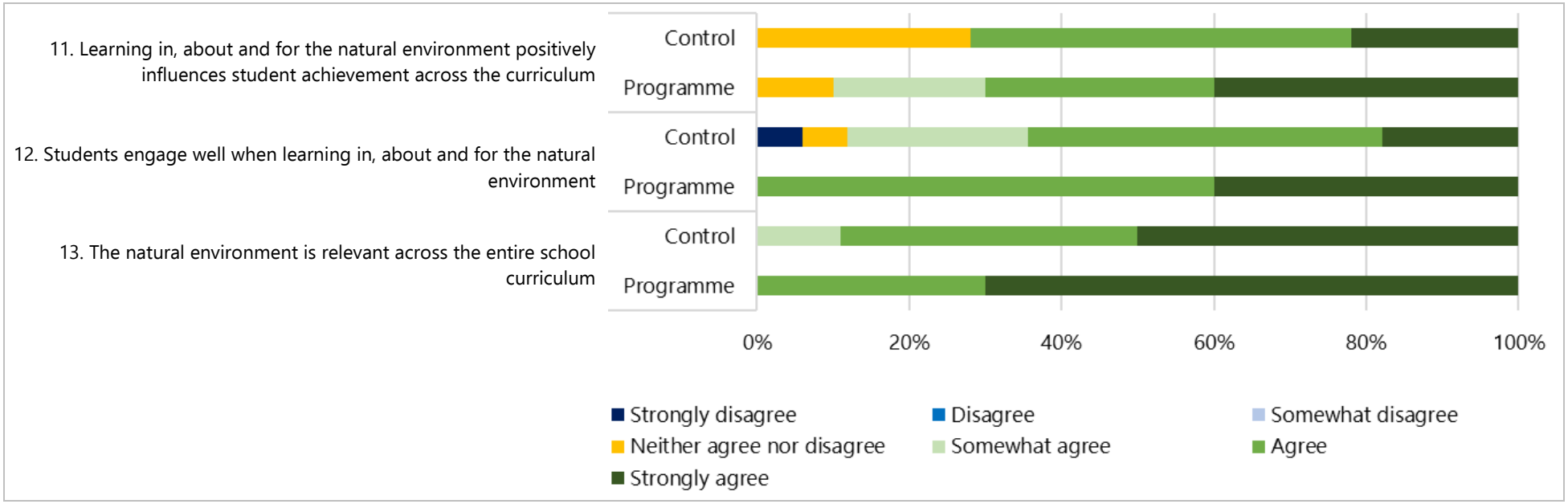

Figure 20 Teachers' attitudes to learning in, about and for the natural environment across the entire school curriculum.

6.3 Biodiversity knowledge

Participants were asked to rate their understanding of the term 'biodiversity'. Those teachers involved with the education programme were asked about their knowledge before and after participating in the education programme. A 5 point Likert scale from "Poor" to "Excellent" was used for these questions. Results show that biodiversity knowledge without participating in the Cape to City education programme was similar for both groups but there was a shift from 'fair' to towards 'excellent' after teachers had participated in a Cape to City education programme (Fig. 21).

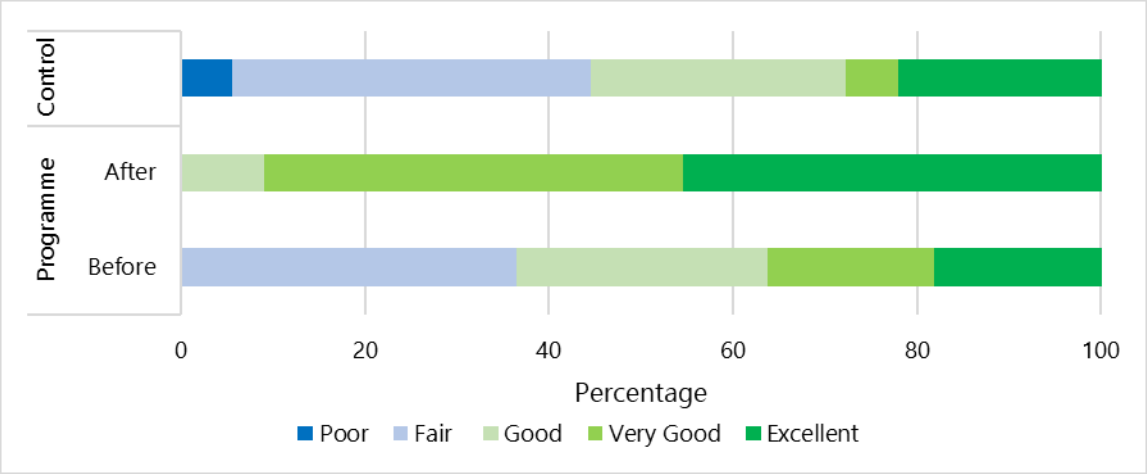

Figure 21 Participants' understanding of the term "biodiversity". Participants were either involved in the Cape to City education programme (Programme) or not involved (Control).

Teachers who participated in the Cape to City education programme indicated that they had an increased awareness of local community environmental initiatives and green spaces.

6.4 Environmental behaviour and action

The next section examines self-reported environmental behaviour and action with four statements that draw a comparison between the control and programme participants. Figure 22 provides a summary of these responses.

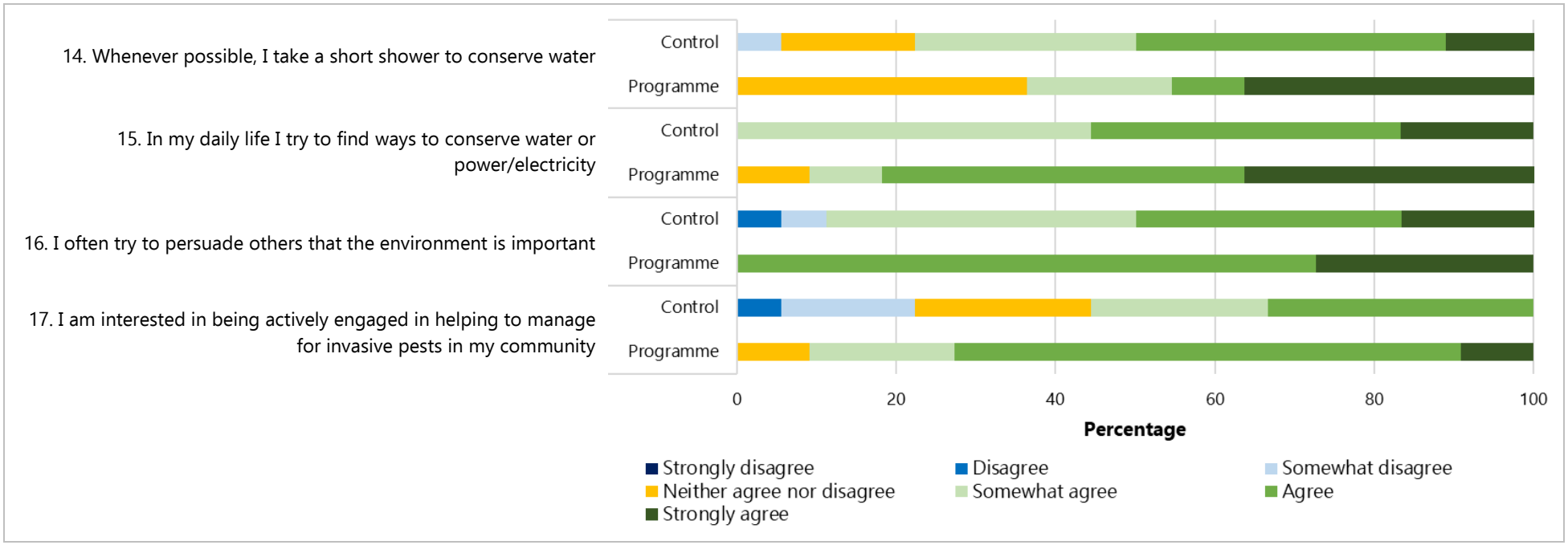

Figure 22 A summary of environmental behaviours and actions by participants either involved in the Cape to City education programme (Programme) or not involved (Control).

There is no clear evidence that those respondents participating in the Education programme are taking shorter showers to conserve water than the control group (Statement 14) or are more diligent about conserving water or power (Statement 15). Programme participants were more committed to "persuading others that the environment is important" (Statement 16) and more interested in being "actively engaged in helping to manage invasive pests in their communities" than their control group colleagues (Statement 17).

6.5 Environmental practices embedded within school culture

The survey asked respondents to what extent environmental practices were embedded and implemented within their school culture (Figure 23). The results indicate that programme participants believe environmental practices are more highly embedded within their schools than the control group of teachers.

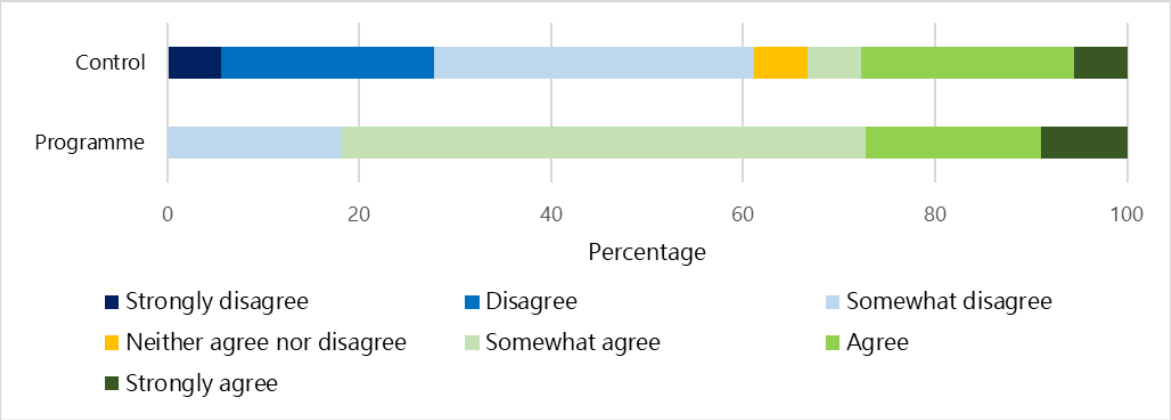

Figure 23 The extent of environmental practices being embedded within school cultures by participants either involved in the Cape to City education programme (Programme) or not involved (Control).

When deciding who should be involved in decision making and implementation of environmental practices in a school, the responses were closely matched for the control and programme participants. School principals, school caretakers, gardeners, and teachers were rated most likely to be involved with making decisions about environmental practices and how to implement them. However, principals' involvement in implementation is lower compared with their influence in the decision-making process. Caretakers and gardeners are key personnel when embedding environmental practices into a school, according to participants in this survey.

6.6 Networking

Networking and new alliances made by teachers both within and outside the school community are important to gain confidence running environmental education programmes. Figures 24 and 25 determine the extent of the networks that support learning and teaching about the environment both within and outside the school community. The programme teachers reported that the Cape to City education programme was useful in developing networks within the school community, but that they were able to make more connections in the wider school community as a result of being in the Cape to City education programme (Fig. 24).

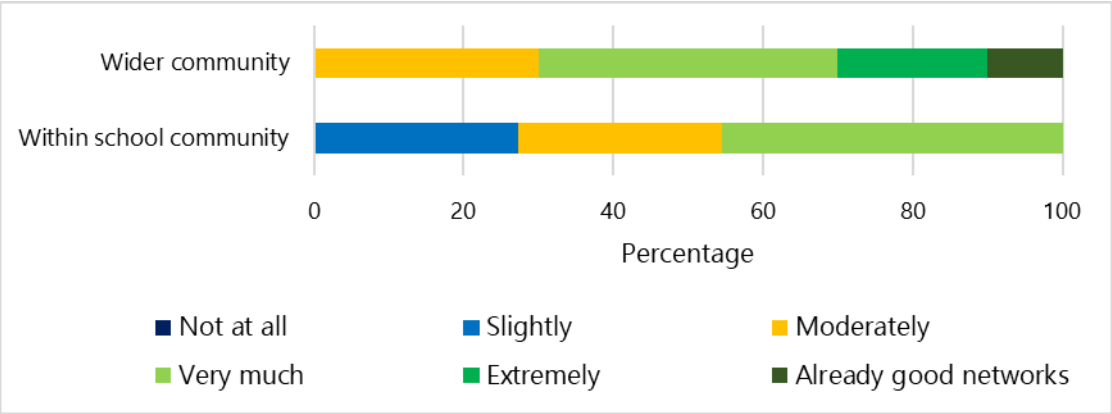

Figure 24 Networking opportunities by programme participants within and with the wider school community.

There was little difference between the networking opportunities within or outside the school community by the control group, but the majority of teachers reported that networking was 'limited' or 'reasonable' (Fig. 25).

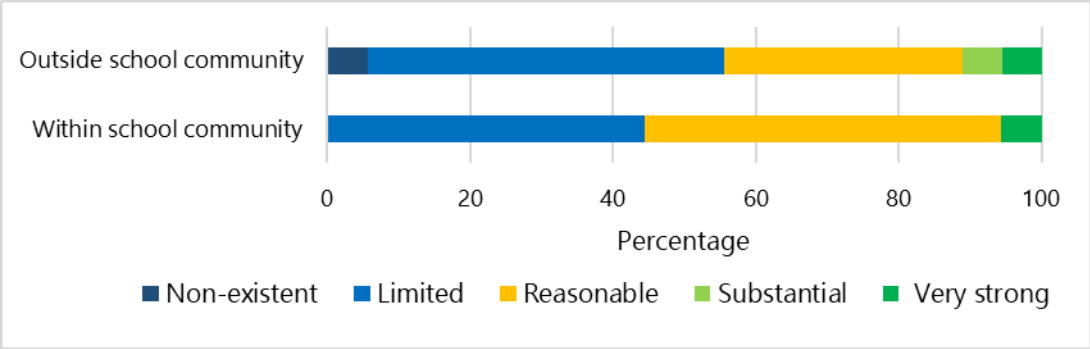

Figure 25 Networking opportunities by control participants within and outside the school community.

6.7 Cross-curricular context

As stated for participants in the survey, "A cross-curricular approach to teaching is characterised by sensitivity towards, and a synthesis of knowledge, skills, and understanding from various subject areas", Both groups of respondents were asked how often they used the environment in a cross-curricular context (Fig. 26).

Both groups indicated that they use the environment as a cross-curricular context for learning, however, the programme participants used this approach more frequently when compared to control participants.

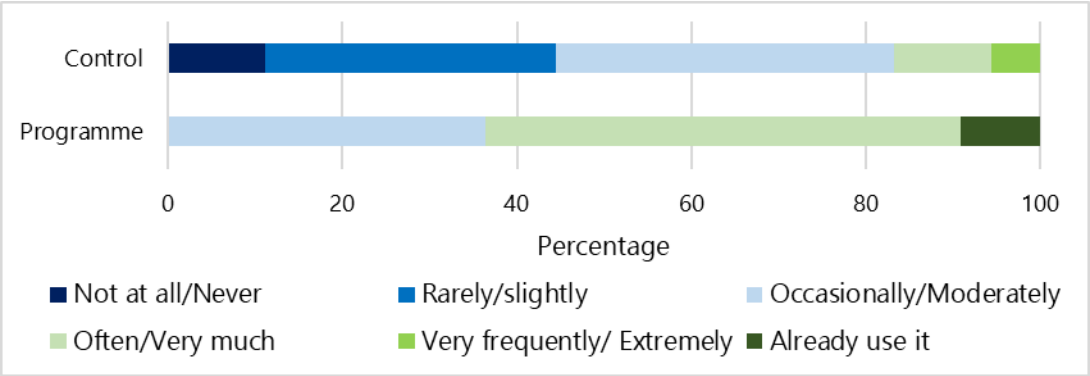

Figure 26 Frequency of using the environment in a cross-curricular context.

Two additional questions were asked of the programme participants. The first question asked whether the teachers had continued to use the environment in "a cross-curricular context" for learning after the programme ended, and all 11 programme respondents indicated that they had.

The second question asked how long after the end of the Cape to City education programme the respondent continued to use these teaching practices. Three programme participants indicated that they used the environment in a cross-curricular learning context for one to two school terms following completion of the programme. Seven participants indicated that they had integrated the environment in a cross-curricular context for learning into their ongoing teaching practice.

These findings show that engagement with the Cape to City education programme has led to teachers integrating environmental concepts across the curriculum giving students holistic, real life environmental learning.

6.8 Barriers to change

All participants in the survey were asked to select the barriers that limited them from maintaining positive changes to their teaching practice curriculum on the environment. The results are presented in Figure 27. The greatest perceived barrier for both groups was an overcrowded curriculum and time limitations, followed by a lack of funding for fieldtrip transport. However, one barrier that differed significantly between the two groups was that the control group considered risk management processes to be too complex to make fieldtrips worthwhile and outdoor learning was not suitable for current class dynamics. Other barriers highlighted by both groups included: a lack of school support; a lack of confidence in teacher knowledge of the subject matter; and some difficulty connecting with outside 'experts' to assist with learning.

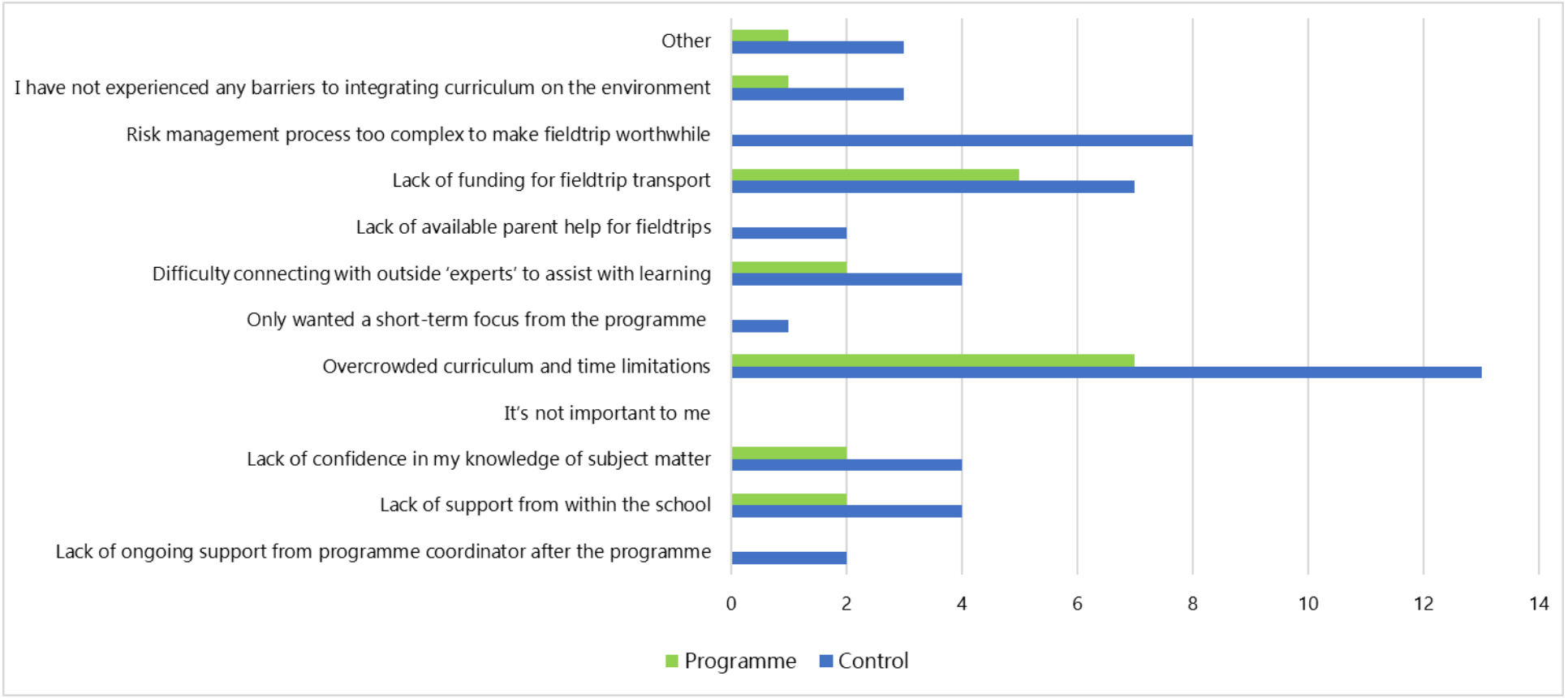

Figure 27 Perceived barriers to maintaining positive teaching practices on the environment by participants either involved in the Cape to City education programme (Programme) or not involved (Control).

6.9 Student engagement with the environment

Both groups were asked about the types of activities their students engaged in for the environment (Fig. 28). The top two responses for both groups were enhancing the environment within the school grounds and talking with or teaching others about the environment. However, students were also involved with activities to enhance the environment outside of the school grounds in both groups. Creating or restoring habitat for native species within the school grounds and becoming involved in environmental initiatives outside the school grounds were ranked next highest. For all activities, except two, the programme participant group reported much higher responses than the control groups. Responses are generally higher for activities taking place within school grounds for both groups compared to those taking place outside of them.

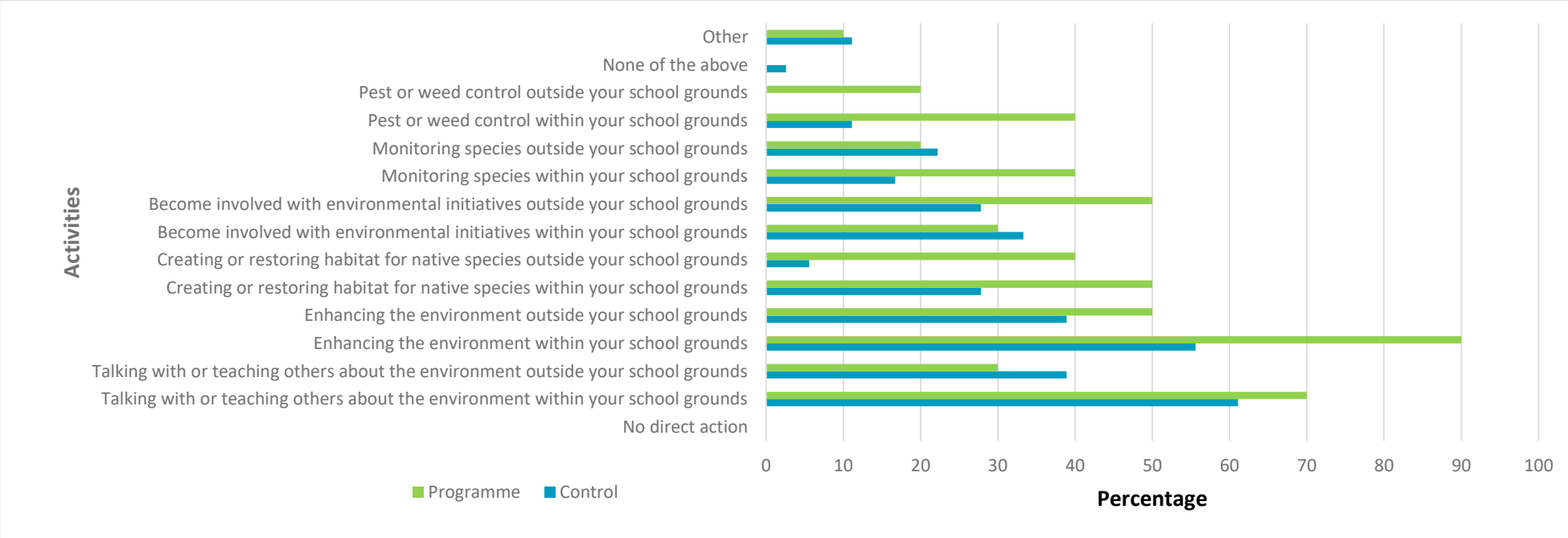

Figure 28 Types of activities students engage in for the environment participants either involved in the Cape to City education programme (Programme) or not involved (Control).

Teachers participating in the programme agreed that their students demonstrated a change in their ability to think of wider concerns about the environment and that the Cape to City Education programme positively influenced students' personal development in terms of thinking and behaviour. The majority of these changes were rated as moderate to significant in all the key competencies listed, i.e. relating to others; using language, symbols and texts; managing themselves; and participating and contributing. There was an indication that some of the students were sharing these learnings at home.

6.10 Environmental digital resources

Digital resources provide an important environmental education tool for teachers and students. Survey respondents from both groups were asked about their awareness of a selection of digital resources and which ones they had used or engaged with in their class (Fig. 29). Over 80% of the programme participants were aware of and had used the Department of Conservation (DOC) general education resources, whereas 56% of the control group knew about this resource, but only 28% had used it. Four (22%) of the control group teachers were not aware of any of the digital resources. Overall, the teachers from the programme participant group were more aware of and had utilised the digital resources compared to the control group.

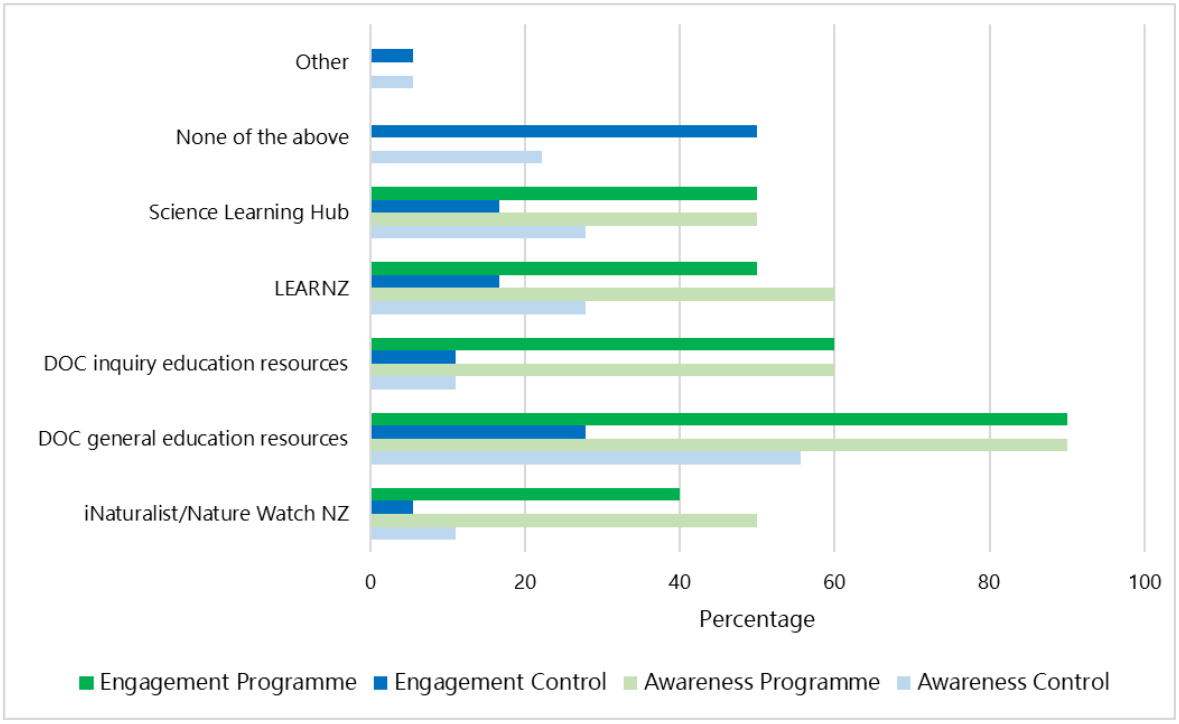

Figure 29 Awareness of and engagement with digital resources by both teachers participating in the programme and the control group (DOC = Department of Conservation).

6.11 Environmental initiatives and organisations

Survey respondents were asked about their awareness of and engagement with several organisations and environmental initiatives. For both participant groups, the National Aquarium of New Zealand (Napier) is the best known organisation and the organisation teachers of both groups are most engaged with (Fig. 30). While teachers are aware of the Enviroschools initiative, only a few teachers from either participant groups are engaged with this initiative.

Teachers involved with the Cape to City education programme are aware of and engaged with environmental initiatives that include the Hawke's Bay Regional Council – Environmental Education, The Cape Sanctuary, Fish and Game Council, and to a lesser extent, Habitat Heroes, but are not aware of or engaged with Kiwi Guardians, Outlook for Someday or the Hawke's Bay Environment Youth Council.

While only one teacher from the control group wasn't aware of any of the organisations or environmental initiatives, seven teachers were not engaged with any of the initiatives compared to only one of the teachers in the Cape to City education programme.

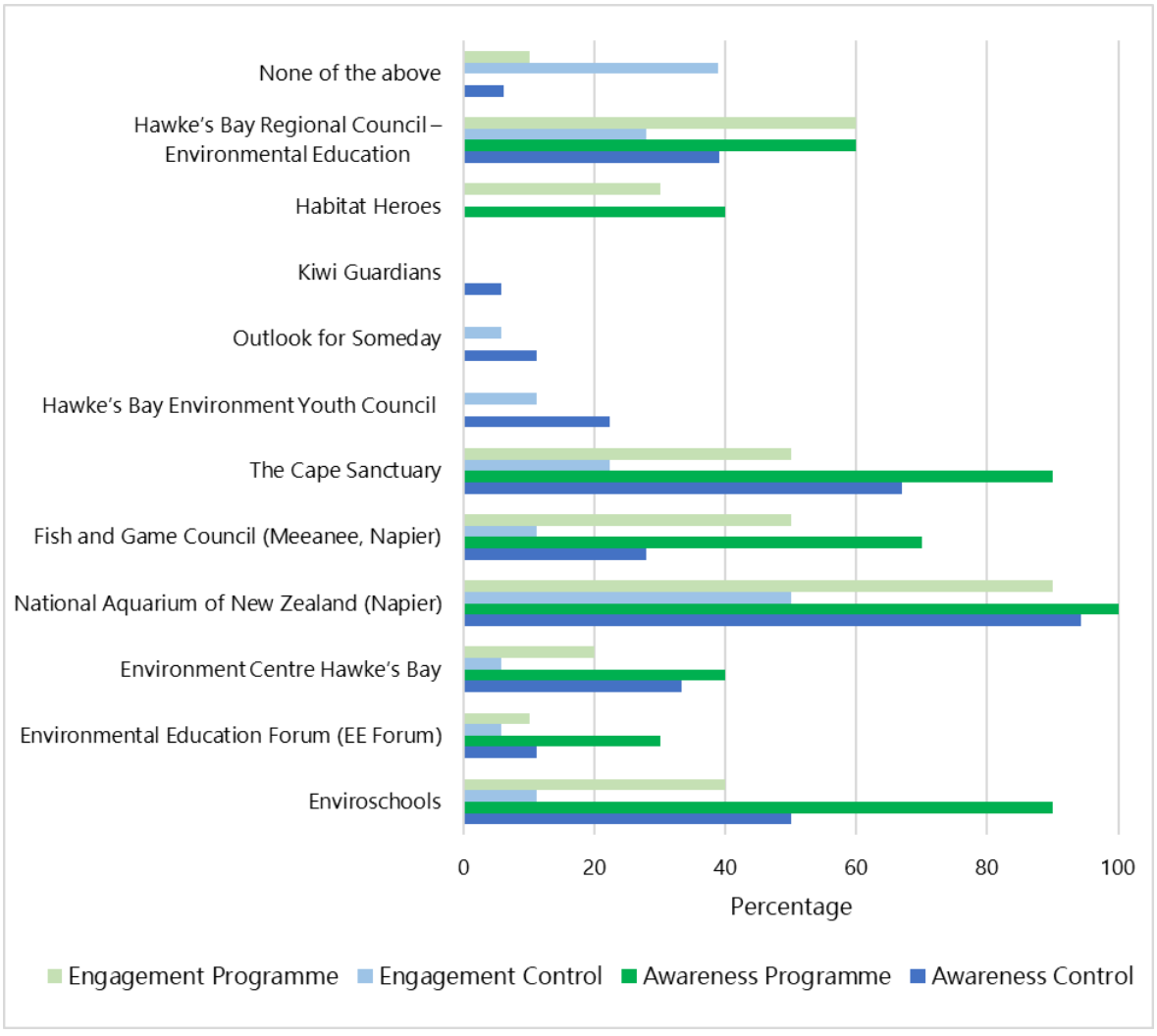

Figure 30 Awareness of and engagement with organisations and environmental initiatives by participants in the Cape to City education programme and control groups.

6.12 Cape to City education programme support

Delivering an environmental education programme can be time and labour intensive. To better understand which components of the programme are most critical for delivery, participants were asked if the Cape to City education programme was handed to teachers to deliver, without expert presenters, which aspects of the programme would they require or prefer support with (Fig. 31). Networking with agencies or experts to support learning and physical resources were both rated as the most important types of support for teachers in schools. Teachers also thought that a strong topic knowledge base or the ability to access knowledge about a topic would also be important. Linked to this support is the need for access to digital resources and website links, and related cross-curricular activity ideas for extending learning.

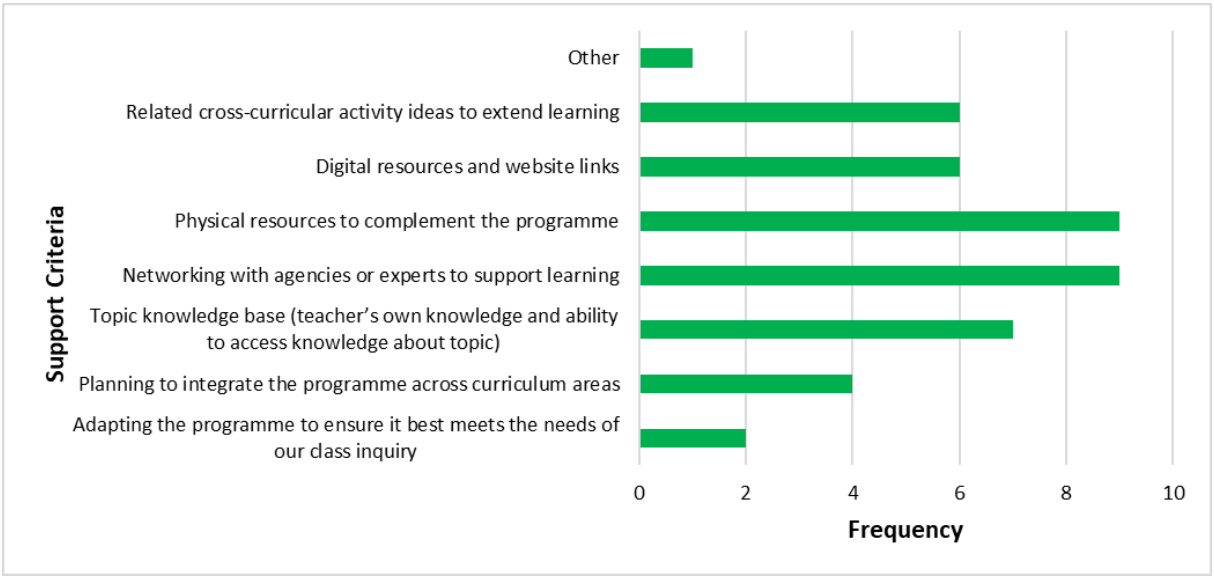

Figure 31 Support required for implementing the Cape to City education programme into schools without specialised education presenters (programme participants only).

6.13 Summary of survey findings

The two surveys carried out by Cape to City education programme participants and a control group attempted to measure the impact of the Cape to City education programme. However, due to the timing of the survey and a subsequent low response rate by participants in the Cape to City education programme, the survey was only able to give indicative results. In addition, the results show a potential bias towards females, as 82% of the programme participants were female compared with 50% in the control group. Therefore, these results should be interpreted within this context.

However, there is strong support for the Cape to City education programme and indicators that the programme is beneficial to both teachers and students engaging in them. The teachers involved in the programmes see positive cross-curricular environmental learning that benefits the whole school and wider community. Surprisingly, the response rate of the control group was much higher than the programme respondents, and was useful for comparative purposes.

Overall, the programme participant group has demonstrated stronger environmental beliefs and attitudes, greater environmental knowledge, and a greater number of environmental actions were undertaken when compared to their control group colleagues. However, whether these benefits are due solely to the Cape to City education programme or to the inherent nature of the programme participants who volunteered is difficult to determine.

7 Conclusions and recommendations

The overall conclusion drawn from this review of the Cape to City education programme is that the programme is delivering successful hands-on, inquiry-based environmental learning for students in the Hawke's Bay region. Teachers and students have engaged enthusiastically with the programme and have increased their environmental knowledge, changed their attitudes towards the environment in a positive manner, and carried out significant environmental actions. Most teachers involved in the programme also reported that they have embedded environmental principles into their everyday teaching practices. The literature review informed both the design of the questionnaires and the thematic analysis of the benefits of environmental education programmes. We categorised these as increasing student engagement, lowering anxiety, improving decision making, and creating a stronger bond with nature.

A key finding of the literature review was that Environmental Education programmes are highly successful at meeting knowledge and competency outcomes but are not quite as successful at measuring changes in dispositions and behaviours (Ardoin et al. 2018). This research provides a limited evaluation of the Cape to City education programme's engagement with both teachers and students. A quantitative impact assessment has not been achieved due to the low response rates to the survey and potential bias in the design. The literature review, however, does confirm the importance of regular evaluation and research assessment before, during, and at intervals after the completion of a programme.

A core component of the Cape to City education programme is the relationship established between teachers, community groups and other organisations and it is important that these are maintained and developed further within the school community. The Cape to City education programme has a strong and important partnership with EIT Hawke's Bay that will ensure developing teachers learn about the programmes and the environmental contexts for education will continue to be embedded into their Bachelor of Teaching Early Childhood and Bachelor of Teaching Primary education courses.

Finally, the Cape to City education programme is founded on a sound model for engaging with schools in Hawke's Bay, which includes building partnerships, and taking a holistic approach and setting long term goals. Through aspirational visions; understanding; new skills, convenient design, delivery, and management systems; trust; change moments and reinforcement, there will be not only environmental benefits to enhance the biodiversity of the Hawke's Bay region but also positive social and cultural benefits for the whole community.

8 Acknowledgements

This review was funded through Cape to City and Poutiri Ao ō Tāne (a partnership between the Department of Conservation, Manaaki Whenua Landcare Research, the Aotearoa Foundation, Hawkes Bay Regional Council and Cape Sanctuary). The review team across these organisations acknowledge that Stephen Flood began this project, which was then finalised by Robyn Kannemeyer. Her dedication to this work is truly appreciated. This review is not an independent evaluation and thus should be read as an internal review to aid further development of Cape to City and Poutiri Ao ō Tāne and related education initiatives.

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